IMPACT OF THE MEDICARE FEE FREEZE ON PHYSICIAN EXPENDITURES AND VOLUMES

Final Report

CENTER FOR HEALTH ECONOMICS RESEARCH

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1.0 INTRODUCTION AND EXECUTIVE SUMMARY

1.1 Statement of the Problem

Continued double-digit inflation in Part B expenditures led Congress to make some major changes in Medicare physician payment in the summer of 1984. Specifically, the Deficit Reduction Act (DEFRA) imposed a fee freeze on Medicare services and altered the terms of physician participation in Medicare.

Under DEFRA, Medicare customary and prevailing charges were frozen for a 15-month period from July 1, 1984 to September 30, 1985. Actual charges (those submitted or billed by physicians, as opposed to what Medicare actually will pay) were also frozen, but only for those physicians who did not sign the participation agreement. Participating physicians were allowed to increase their actual charges during the freeze period. Because allowed (customary and prevailing) charges were frozen, higher actual charges were on paper only and did not translate into higher Medicare payments. These higher actual charges, however, were to be taken into account when the charge profiles for participating physicians were updated at the end of the freeze. This was one of the inducements for physicians to sign the agreement, as nonparticipants would not get a comparable update.

Since DEFRA, further changes in physician payment have been enacted, including the extension of the Medicare fee freeze in fiscal year 1986. Many participating physicians may have felt that they had been "double-crossed", as lower participation rates were observed for the second agreement period. HCFA reported that 27.9 percent of physicians signed the October 1985 agreement (versus 29.8 percent in October 1984).

The freeze on prevailing charges for participating physicians was lifted about seven months later, and these physicians received a fee update in May 1986. Reimbursement rates for nonparticipants remained frozen through the end of December 1986.

Despite the freeze, total Part B outlays have continued to increase at double-digit rates (see Table 1-1). Furthermore, while the rate of increase does appear to have slowed, the deceleration may have begun before the start of the freeze. Fiscal year 1984 expenditures increased "only" 11.2 percent over the previous year, considerably down from the 17 percent plus-rates of growth earlier. Since the 1984 fiscal year included only three months of frozen fees, it is possible that spending increases had already begun to slow (possibly in response to the implementation of PPS). We need comparable data by quarter in order to determine the exact timing of this deceleration.

Of course, Part B outlays increased at least in part due to increases in Medicare enrollment. Generally, however, growth in the number of beneficiaries accounts for only 2 percentage points of the annual percent increases in spending (compare columns 2 and 4 of Table 1-1). Even after

TABLE 1-1

INCREASES IN MEDICARE PART B SPENDING, FISCAL YEARS 1980-1986

	Total		Per Beneficiary	
Fiscal Year	Dollars (in millions)	Percent Increase (over prior year)	Dollars	Percent Increase (over prior year)
1980	$10,746	22.1%	$396.34	19.5%
1981	13,240	23.2	478.90	20.8
1982	15,559	17.5	552.13	15.3
1983	18,317	17.7	637.92	15.5
1984	20,374	11.2	696.59	9.2
1985	22,730	11.6	763.24	9.6
1986	26,217	15.3	862.21	13.0

Source: Total outlays were taken from Table 11, p. 157 of House Ways and Means Committee, Background Material and Data on Programs Within the Jurisdiction of the Committee on Ways and Means, 100th Cong., 1st Session, 1987. Per beneficiary outlays were calculated from Table 1, p. 139 and from Table 11, p. 157, based on the same source.

adjusting for the number of beneficiaries, we see that Part B spending in fiscal year 1985 increased 9.6 percent, even though fees were frozen for the entire year. The rate of increase began to accelerate again in 1986, as per beneficiary spending jumped 13 percent above the previous fiscal year's level. Participating physicians received a modest fee update in May, so higher reimbursement rates for some physicians for five months of the fiscal year will account for some of this increase.

The fact that frozen fees did not result in frozen expenditures should not come as a surprise to policymakers. Experience with the Economic Stabilization Program in the early 1970's showed that price controls for physicians were accompanied by a substantial increase in the number of services and a much larger than expected growth in total Medicare payments to physicians (Hadley and Lee, 1979). There was no reason not to expect a similar outcome in the 1980's.

For policymakers today, however, the important task is to understand how and why spending on physicians' services grew during the fee freeze. How much is due to increases in the volume of services, and how much to changes in the codes used to bill for services? This project sought to answer these questions and many others, using Part B physician claims data from four states for 1983-1986. In particular, we address the following policy questions:

- What has been the year to year, and quarter to quarter, increase in total Part B spending per beneficiary during this time period? By type of service? By specialty?
- Can we decompose the increase in total spending by the source of the increase? Which procedures have been growing most rapidly? Which specialties are performing them?
- How has the location of service been changing over this time period? Do we observe a substitution of office for hospital visits?
- Can we disentangle "real" volume effects, from those due to PPS, the elimination of combined billing, and increased substitution of ambulatory for inpatient care?
- Is there any evidence of "upcoding"? If so, what has been its effect on total spending?
- Can we isolate and measure the dollar impact of the fee freeze on per beneficiary expenditures? This requires adjustment for PPS transition, changes in physician supply, and changes in patient demand.

These issues and many others are analyzed in the subsequent chapters. A summary of our principal findings is presented in the next Section.

1.2 Summary of Findings

A unique data base was assembled to analyze the impact of the fee freeze on Medicare physician expenditures: a cross-section time series of 100 percent Medicare physician claims data for 1983-1986 from Alabama, Connecticut, Washington, and Wisconsin. These states were chosen in order to represent the four major geographic regions and because they all used the same procedure coding terminology (HCPCS) throughout the time period. The four year study period provided us with an 18-month baseline before the freeze, as well as nine months prior to the implementation of PPS. It also covers the entire duration of the freeze, plus seven months post-freeze for participating physicians (who received a fee update in May 1986).

The policy questions we attempted to study can be divided into two basic areas of analysis. The first is a detailed description of what happened to spending on physicians' services from 1983 to 1986. Specifically:

- What accounts for the increase in Part B expenditures over this time period? What kinds of services and procedures were rising faster than others?
- Can we identify the sources of the increase? How much can be attributed to a simple growth in the volume of services per capita? How much to upcoding, i.e., to an increased propensity of physicians to bill their services using more complex (and more expensive) codes? How much can be attributed to new technology and the substitution of new, more costly procedures for old ones?

The second area of analysis explores the causal relationship between the fee freeze itself and expenditure growth. For example:

- Did the freeze help drive up Part B spending, or did it actually slow secular growth trends?
- What impact did the implementation of PPS have on physician expenditures?

1.2.1 Descriptive Findings

What Happened to Physician Spending?

Medicare physician expenditures per beneficiary increased 35.5 percent from the beginning of 1983 to the end of 1986 in the four states. Spending rose steadily over this four-year period, except for an abrupt 4 percent drop in the third quarter (July-September) of 1984. By early 1985, however, expenditures had already exceeded their previous levels. Although this drop coincided perfectly with the start of the fee freeze itself, it is probably not causally related. Instead, there are probably two main reasons for this (short-lived) decline in spending.

First, the drop also coincided with the implementation of the direct billing requirement for laboratory services. This law prohibited physicians from billing for lab tests which they do not personally perform in their offices. Nevertheless, the fall in lab spending accounted for only one-fifth of the total drop in expenditures in mid-1984.

Second, the four percent drop was concentrated entirely in the inpatient setting, with expenditures falling for all types of service. While spending reductions for inpatient surgery and radiology were partly offset by increases in ambulatory services, there was a sharp decline in hospital visits with no corresponding offset by office visits until 1985. Examination of Part A claims revealed an abrupt drop in admission rates in the third quarter of 1984, with a further reduction in the following quarter. The last (and disproportionately large) cohort of hospitals came onto PPS in July of 1984. Together with the operationalization of the PROs, this may have acted as a "shock" to physician practice patterns.

Table 1-2 decomposes the growth in spending into its component sources by type of service. For comparison, we also include each service type's share of total expenditures. Services growing disproportionately faster than average include surgery, radiology, and special tests.

- Increased spending on surgical procedures is by far the most important factor, representing over two-fifths of the expenditure growth.
- Just two procedures, cataract surgery and colonoscopies, account for one-third of the increase in surgical expenditures, and for over one-seventh of the increase in total physician spending. Other operations, whose volume growth has contributed disproportionately, include CABG surgery, cardiac catheterization, upper GI endoscopy, and total knee replacement.
- Increased spending on radiology services is due to increased volumes, especially for more expensive procedures like CAT scans, as well as to the advent of new technologies like magnetic resonance imaging (MRI).
- While special tests represent only 5 percent of total spending, they account for almost 11 percent of the increase. Volumes increased for both routine and rhythm ECGs, ophthalmoscopy, echocardiography, and cardiac stress tests, among other services.

The Shift to Outpatient Care

There has been a dramatic shift of physician services out of the hospital and into outpatient settings over our study period, a trend due largely to the introduction of PPS. While almost two-thirds of the Medicare physician dollar in our four states was spent in the hospital in 1983, that had fallen to just under one-half by 1986. By contrast, the percent of total

TABLE 1-2

SOURCES OF INCREASE IN PER BENEFICIARY SPENDING FOR PHYSICIANS' SERVICES, 1983-86

Type of Service	Percent of Increase	Percent of Total Expenditures
Medical Care	17.9%	31.6%
Consultations	3.0	3.1
Surgery	41.3	35.8
Anesthesia	4.6	4.7
Assistant Surgery	1.5	2.6
Radiology	15.3	12.6
Laboratory	-0.1	3.0
Specialized Tests	10.6	5.3
Other	5.9	1.3
	100.0%	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

spending in physicians' offices rose from 29 to 33 percent, while the share spent in outpatient departments and ambulatory surgical centers almost tripled (from 6% to 15%).

This shift has important implications for Part B spending. First, as radiology services and special tests are increasingly provided outside institutional settings, Part B expenditures may increase as physicians submit bills for both the interpretive and technical aspects of the procedure. (The technical portion continues to be billed through Part A if the procedure is performed in the hospital or outpatient department.)

Second, unlike the hospital setting with its fixed case payments, fee-for-service incentives may encourage physicians to provide more tests in their offices. Anecdotal evidence suggests that in-office testing has greatly increased over the last few years. Third, some tests, especially routine x-rays and ECGs, are interpreted by hospital residents with no Part B bill submitted. As admission rates and lengths of stay decline, these tests may be increasingly interpreted by private practice physicians outside the hospital.

The mix of office and hospital visits certainly change, as hospital stays shorten and more care is provided on an ambulatory basis. In fact, the substitution of office for hospital visits has been one-for-one. The average beneficiary received the same number of visits in 1986 as in 1983 (5.8), but in a very different setting. Total outlays still rose over 12 percent, however, as physicians submitted bills with more complex codes for both office and hospital visits.

While Medicare Part B expenditures per beneficiary were 29.5 percent higher in 1986 than in 1983, the rate of increase varied considerably by physician specialty. Spending grew far more slowly for services provided by general and family practitioners (13%), by internists (17%), and by general surgeons (9%). Rates of increase exceeded 40 percent, however, for a number of specialists, including dermatologists, cardiologists, gastroenterologists, ophthalmologists, thoracic surgeons, and psychiatrists.

- Many of these specialists provided relatively more office and hospital visits over time, implying a substitution of specialists for primary care physicians.

- Surgery accounted for the majority of the increased spending for all of these specialists, except cardiologists and psychiatrists. The growth in spending for cardiologists' services was due, in almost equal parts, to more visits and consultations, more cardiac tests, and more cardiac catheterizations.

- Spending for gastroenterologists rose 73 percent from 1983 to 1986, with most of the increase due to two procedures: colonoscopy and upper GI endoscopy.

Why Expenditures Rise Faster Than Volumes

Expenditures per beneficiary for a given service generally always rise far faster than do the actual number of services. Conversely, when relative volumes fall, as they do for hospital visits and for some surgical procedures like permanent pacemaker insertion, the corresponding expenditures fall much more slowly. There are (at least) four possible explanations. First, there are some real price updates during our study period:

- In July 1983, physicians received their usual MEI-constrained increase in prevailing charges.
- In May 1986, participating physicians received a modest increase in both their customary and prevailing charges.

These updates accounted for about one-third of the total spending increase from 1983 to 1986. Second, there has been a shift toward more expensive physicians:

- Specialists (who often are reimbursed more for the same service) account for a slightly larger share of the Medicare dollar in 1986 than in 1983.

Third, technological advances may encourage the substitution of more expensive procedures. In general, it is difficult to identify such one-to-one substitutions, but we can in the case of lens procedures:

- The total number of lens procedures per beneficiary increased 50 percent in just three years. This included a 64 percent increase in one-stage procedures (extraction plus insertion of an intraocular lens), with an offsetting reduction in extraction-only operations.
- Nevertheless, because reimbursement for one-stage procedures averages 50 percent more than for extraction alone, total Medicare expenditures for lens procedures increased 61 percent.

The final explanation is a shift in procedure code mix. Physicians may be billing more expensive visit codes than previously:

- The relative frequency of simpler office and hospital visit codes has definitely declined over our study period, with corresponding increases in more complex codes.
- If physicians had billed their 1986 office and hospital visits with the same relative frequency as 1983, the Medicare program would have "saved" over $20 million in our four states, or about 7 percent of actual 1986 physician outlays.

While evidence of significant "upcoding" is indisputable, this does not necessarily imply fraudulent billing practices on the part of physicians. The introduction of PPS has probably altered the content and intensity of both office and hospital visits. The average patient treated in both settings simply may be sicker and more complicated to treat. Thus, as with our other descriptive findings, it is important to control for PPS and other factors before ascribing any changes to the freeze.

1.2.2 Econometric Findings

A random effects model was used to estimate the impact of the fee freeze on expenditures and services, holding other factors like increased physician supply and declining hospital use constant. The effect of the freeze was captured by changes in the real Medicare allowed charge. Given the eroding effects of inflation, real charges showed a steady, gradual decline over the July 1984 to May 1986 period. The effect was an increase in weighted quantities per beneficiary attributable to the fee freeze. This finding is consistent with the hypothesis that physician supply is backward-bending, and that a reduction in real price moves the physician down along his (her) supply schedule, encouraging even greater supply. This occurs, in turn, because income-targeting physicians are more affected by the freeze's reduction in their real incomes than by the price incentives to move out of the Medicare market. An alternative explanation for this finding is that the freeze stimulated demand in demand-constrained markets.

Nevertheless, this does not necessarily imply that the freeze resulted in increased program expenditures. The percentage reduction in the real Medicare allowed charge must be subtracted from the percent increase in quantity in order to calculate the net effect of the freeze on Part B expenditures. Our best estimate is that the freeze reduced program expenditures slightly, holding all other factors constant.

Although the freeze appears to be a contributor to growing volume during this period, it is not the only factor.

- Increases in both real incomes and physicians per capita had significant, positive effects on Part B spending. In part, these two variables may capture technology growth, which was not explicitly captured in our model.

- Declining hospital utilization also appeared to have an initial negative, and then a longer-run positive, impact on quantity.

Declines in Medicare hospital days over this time period can be attributed to the implementation and continued phase-in of the Prospective Payment System, as well as to a secular trend toward outpatient surgery. The apparent substitution of physician for hospital services may reflect several factors. First, with declining lengths of stay and admission rates, physicians may need

to provide services on an ambulatory basis that were performed by nurses and residents in the hospital setting. Second, physicians may have changed their practice styles to take advantage of the trend toward preadmission testing, e.g., by purchasing in-office diagnostic equipment. The resulting growth in test volume may or may not be medically appropriate. Finally, beneficiaries may demand more ambulatory services, especially outpatient surgery, due to both lower time prices (no hospitalization) and lower money prices (no Part A deductible).

1.3 Overview of the Report

The report includes four additional chapters. Chapter 2 describes our research design, including a discussion of the difficulties of measuring freeze effects during a period of other significant policy changes. This chapter also describes the Part B claims data, file construction, and secondary data sources. Descriptive results are presented in Chapter 3, including changes over time in expenditures, volumes, and procedure code mix. Chapter 4 includes our theoretical model for evaluating fee freeze impacts, empirical specification and estimation methods, and all econometric analyses. Random effects regression results are shown for total expenditures and total quantities, and disaggregated by type of service. Regression results for upcoding are also included.

2.0 RESEARCH DESIGN AND DATA SOURCES

2.1 Measuring Change in a Changing World

This project sought to measure physician behavioral responses to the Medicare freeze on physician fees. Measurement is complicated, however, by the absence of a true control group, as well as by concurrent changes in Medicare regulations that directly or indirectly affect physicians. Because Medicare is a national program, there obviously is no control group of physicians who are treating Medicare patients but who are not subject to the freeze. It is thus difficult to known whether any observed changes, such as upcoding or volume increases, are an explicit physician response to price controls or simply a secular time trend.

One (partial) solution is an adequate baseline period, i.e., a sufficiently long period prior to the freeze in which to establish trends. We also considered the use of non-Medicare physician data as a control group, but were unable to find a private insuror willing to release their claims. However, even this would be only a partial control due to the very different benefit and coverage provisions for office visits. Yet this is precisely the area of greatest potential demand inducement, given PPS incentives to shorten hospital stays and hence reduce inpatient physician billing.

At or about the same time as the start of the freeze, a number of other changes took place in the way Medicare pays physicians or complementary services like hospitals. These include: (1) ongoing procedure code conversion by carriers to a uniform coding system, HCPCS; (2) continued phase-in of hospitals to PPS; and (3) implementation of the direct billing requirement for laboratory services. Each one of these is expected to affect dependent variables of interest and will confound measurement of physician responses to the freeze. We briefly describe each of these policy changes below and discuss their hypothesized impact on physician behavior.

2.1.1 HCPCS Conversion

Historically, each Medicare carrier has maintained its own medical procedural coding terminology. Although many of these coding systems have common roots (e.g. in CRVS, National Blue Shield, etc.), they have evolved over time in response to local area practice patterns and to technology growth. As a result, there is wide variation in the absolute number of procedure codes used by carriers and in the level of detail they represent. This obviously makes cross-carrier comparisons difficult, and HCFA has now required that all carriers adopt a uniform coding system. This uniform system is known as HCPCS and is a slightly modified version of CPT-4, the coding terminology developed by the American Medical Association. Unfortunately, most carriers had not yet adopted HCPCS by the start of the fee freeze in July 1984.

Many of our analyses were not dependent on specific procedure codes, but were based on dollars or on more aggregate levels of service, e.g. number of visits, etc. In other analyses, however, we were interested in capturing more subtle (but equally important) physician responses, particularly procedure inflation or upcoding. These responses can only be measured if the coding system has remained constant over our study period.

Although computerized conversion algorithms have been developed to transform the carrier's original codes into HCPCS codes, they are not sufficiently sensitive for our purposes. Consider office visits, for example, the area we expect to be most susceptible to potential upcoding. HCPCS includes eleven different kinds of office visit codes, reflecting varying levels of complexity: five for new patients and six for established patients. By contrast, the carrier for Michigan had only three codes, two for new patients and one for established patients. Physicians who had been billing the single follow-up code now have a choice of six different codes (and different payment rates) to represent the same activity. In these cases, upcoding is inevitable.

Conversion to HCPCS, however, has been undertaken at different times by the carriers. This means that it was possible to identify carriers who had already converted to HCPCS by the time our study period began.

2.1.2 PPS Transition

Implementation of the freeze was also contemporaneous with PPS transition for hospitals. Initial phase-in of all hospitals was not complete until three months after the freeze started. During the subsequent twelve months (10/84-9/85), furthermore, hospital payment rates shifted from 75% hospital-specific/25% federal rate, to a 50-50 blend. PPS has had three major impacts on hospital care: (1) shorter lengths of stay; (2) avoided admissions; and (3) a shift of testing outside the hospital. Each of these is expected to have had an impact on physician practice patterns. Whether the net effect on Part B expenditures is positive or negative will depend on the complementarity versus substitutability of physician and hospital services.

Shorter stays, preadmission testing, and avoided admissions are all likely to increase Part B outlays for x-rays and other tests, like ECGs. This happens because these tests may be billed as "complete procedures" in the office setting, whereas in the hospital (and OPD) bills are submitted for the interpretation only. Interpretation and report for an ECG, for example, averaged $13 in 1985 (based on BMAD data), but the Part B bill for the entire procedure (actually performing the ECG as well as interpreting it) was $30. Thus, Part B spending may increase even though the test has simply been moved from the inpatient setting to the physician's office.

The shift of surgical procedures from the hospital to outpatient settings is not expected to affect Part B expenditures, on the other hand, as the bill for the operation is unchanged. Cataract operations are an obvious example; here, the entire admission is avoided as the PROs encourage the outpatient provision of these surgeries. The impact of avoided medical admissions on Part B expenditures is less clear. If less seriously ill pneumonia patients are treated on an ambulatory basis rather than in the hospital, are Part B bills larger or smaller? Only empirical data can answer this question, but the extent of office testing and the substitution of private practice physician services for those otherwise provided by hospital residents are probably both important.

Finally, when patients are discharged earlier, there should be some savings in inpatient Part B dollars as fewer physician services are required, especially routine hospital visits. However, since these are marginal days, the savings would not be very large. (This is especially true for surgical admissions in which some, or all, of the routine visits are included in the surgeon's global fee, and hence, never appear as Part B bills.) Offsetting any decline in hospital visits, furthermore, may be corresponding increases in office and OPD visits.

What all of this means is that interpretation of physician responses under the freeze must be done cautiously. Observed changes in volume after July 1984 may be due to PPS as well as the freeze. Although PPS is a national program and hence difficult to hold constant in our analyses, actual implementation occurred at different times. Hospitals began the transition to PPS based on their fiscal year-end date; thus the first wave of hospitals began receiving DRG case payments in October 1983, the second group in January (1984), the third in April, and the final group in July. This staggered time table was maintained for subsequent changes in the blended rates as well (to 50-50, etc.). We can take advantage of this inter-hospital variation in transition to try and hold PPS effects constant.

2.1.3 Changes in Laboratory Service Billing

The direct billing policy for laboratory services was implemented at the same time as the fee freeze. This regulation prevents physicians from billing for any lab tests they do not personally provide in their office. Since physicians are now limited to a simple handling charge, we would expect the volume of lab services provided by physicians to fall.* It thus is not possible to measure changes in lab test volume as potential responses to the fee freeze. This does not affect our overall analyses, however, since lab tests can be separated empirically from other services.

*Total lab volume may be unaffected, as these tests are now billed directly by independent laboratories, but we excluded these facilities from our physician analysis.

Over the long run, Part B spending for physician-provided lab tests will almost certainly increase, for two reasons. First, the greater sophistication of office testing equipment combined with reimbursement changes has encouraged more physicians to establish or upgrade office laboratories. Second, routine lab tests performed in the hospital are entirely Part A costs. Outside the hospital, they are exclusively Part B services. Thus, PPS incentives to shorten stays and perform pre-admission testing are apt to increase Part B expenditures on lab tests.

2.2 Study Design

Given the many national policy changes that have taken place on or about the same time as the implementation of the freeze, it is difficult to hold all of these factors constant. We developed a quasi-experimental study design that attempts to do so, however, by drawing upon some unique primary data sources. The study is a cross-section time-series based on calendar years 1983-1986 inclusive. The great advantage to this time period is that it provides us with extensive data points before the freeze. We have a full 18 months prior to the start of the freeze in which to establish baseline time trends. This also includes nine months before the implementation of PPS. When the design was first developed, we also had a 15 month period post-freeze (October 1985-December 1986). Political events overtook research, however, when the President proposed, and Congress agreed, to extend the freeze an additional seven months for participating physicians and the full 15 months for nonparticipants.

Ideally, the cross-section of physicians would be nationally representative. Unfortunately, the only available national data base, HCFA's BMAD files, had several critical limitations. First, sample sizes in the BMAD provider file were inadequate for many specialty-specific analyses. This was especially true for specialties like ophthalmology who treat a disproportionate number of Medicare patients but who are relatively few in number. Second, the BMAD beneficiary file lacked any geographic identifiers, thus preventing the merge of key area demand and supply variables, such as physician-population ratios, measures of PPS transition, etc. Finally, it was not possible to examine potential upcoding, since the BMAD files, especially for the pre-freeze period, include a mix of procedure coding terminologies. Because there is no one-to-one correspondence between HCPCS codes and those of other systems, it was not possible to evaluate upcoding in those areas where carriers have converted since 1983. Yet upcoding is one of the most likely behavioral responses to the freeze; it helps augment physician revenues without violating the freeze or increasing raw volumes.

In order to conduct area-level analyses with adequate sample size, and in order to study potential upcoding, we collected data from a unique source: Part B claims from carriers who had already converted to HCPCS by 1983. This data source is described in detail below.

2.3 Part B Claims Data

2.3.1 Selection of Study States

Ten carriers had converted to HCPCS by the end of 1983. These carriers (listed on Table 2-1) formed the pool from which we selected our study states. The following criteria were used for state selection:

(1) The four major census regions should be represented. Many studies have shown dramatic geographic variation in physician practice patterns.

(2) Very small states should be excluded. Small (low population) states have few physicians in many specialties, and are probably atypical in other ways. Earlier work with South Carolina claims data, for example, found 17 thoracic surgeons performed all of the CABG surgery; as a result, there was virtually no variation in submitted or allowed charges.

(3) Each carrier should represent areas with varying levels of physician density. Behavior under the fee freeze is hypothesized to vary substantially in response to competitive pressures. This natural variation will be constrained for carriers who serve mostly, or wholly, rural areas.

(4) They should represent a range of assignment and participation rates. Historically, there have been consistent and largely unexplained inter-state differences in assignment and participation rates.

Table 2-1 compares the carriers along these dimensions. Size alone rules out a number of carriers, e.g., South Carolina, the two Dakotas, and (rural) Minnesota. Using the above criteria, we selected four carriers for inclusion in the study: Connecticut General (CIGNA)*, Blue Shield of Alabama, Washington Physicians' Service, and Wisconsin Physicians' Service. Four carriers permitted representation of the four major census regions, while limiting data acquisition and processing costs. Each carrier serves the entire Medicare population in their respective states. Alabama has one of the highest participation rates in the country (54%, based on the original October 1984 sign-up period), while Connecticut's rate of 23 percent is well below the

*Midway through our time-series, Travelers Insurance Company became the carrier for Connecticut.

TABLE 2-1

CHARACTERISTICS OF PART B CARRIERS ON HCPCS PRIOR TO FEE FREEZE

	Patient Care MDs per 1,000 pop.	Assignment Rate (% of charges)	Participation Rate (% of MDs)	Urban (% of pop.)
North East				
Connecticut	2.43	31.2%	23.3%	88.3%
North Central				
Indiana	1.32	25.0	19.4	69.8
Minnesota (rural counties only)	0.88	29.5	18.0	0.0
North Dakota	1.49	33.2	15.0	35.9
South Dakota	1.23	19.8	10.7	15.9
Wisconsin	1.59	35.6	34.7	66.8
South				
Alabama	1.31	60.1	53.9	62.0
Arkansas	1.28	52.2	44.6	39.1
South Carolina	1.36	61.1	48.0	59.7
West				
Washington	1.79	34.2	27.2	80.4

national average of 30 percent. Washington physicians signed up at rates somewhat below that for U.S. physicians as a whole (27%), while Wisconsin physicians were somewhat above average (35%). The relative supply of patient care physicians ranged from 1.31 per 1,000 population in Alabama to 2.43 in Connecticut.

2.3.2 File Construction

Raw Part B claims were obtained directly from the carriers for each of the four years in our time-series. Files were continually updated, as late claims were received; thus, claims for services provided in one calendar year but not submitted until the following year were placed back into the appropriate time period based on date of service. Over forty million claims were received for each year. We excluded all non-physician providers (including independent laboratories) and all non-physician services, such as durable medical equipment, injections, etc.

Claims were then aggregated to the provider level for each quarter of the study period. The aggregation was done in such a way so as to preserve as much procedural detail as possible, e.g., the number of visits provided under procedure code 90060, total allowed charges associated with that code, etc. In order to maximize the total number of individual procedures for which we had this level of detail, specialty-specific procedure lists were developed for use in the aggregation process. These lists were based on the most frequently performed services for each specialty; procedure detail on office visits, hospital visits, and consultations were retained for all specialties. Summary data by type of service and location of service were also constructed for all providers.

Although HCFA has a standard set of "type of service" groupings that it uses, these definitions are not uniformly shared by carriers. In order to have comparable definitions across carriers and over time, we developed our own categories based on procedure codes. Table 2-2 defines our nine type of service groups. They are generally similar to those used by HCFA, except that we have added the category "specialized tests" which includes ECGs, cardiac stress tests, pulmonary function tests, and many other special services and procedures located in the 90000 series of HCPCS. Individual carriers commonly assign these tests to any one of three different categories (medical care, radiology, or laboratory); analysis of spending increases by type of service using carrier definitions thus could lead to highly erroneous estimates.

We had originally planned to conduct many analyses with the physician as the unit of observation. Once the physician aggregates were constructed, however, we found dramatic changes from year to year in the number of unique provider IDs. This occurred in all four of our states (see Table 2-3) and in all specialties (not shown). The problem is that carrier provider IDs do not represent a single physician or even a single group practice. The number of

TABLE 2-2

STUDY DEFINITION OF TYPE OF SERVICE CATEGORIES

Category	Procedure Codes
Medical Care	All visit codes in the 90000 series including prolonged and critical care services (except consultations), gang nursing and SNF visits (in the"M" series of HCPCS), psychiatric services, and dialysis.
Consultations	All consultation procedure codes.
Surgery	All surgery codes (20000-69999, T series) with type of service surgery, plus all cardiac catheterization services.
Anesthesia	All codes with type of service anesthesia, plus qualifying circumstances for anesthesia (99100-99140).
Assistant Surgery	All codes with type of service assistance at surgery.
Radiology	All codes in the 70000 and R series, except echocardiography and Doppler peripheral flow studies.
Pathology	All codes in the 80000 and P series, plus the codes for specimen handling charges (99000-99002).
Special Tests	Specialized tests and other services from the 90000 series for gastroenterology, ophthalmology (except visits), otorhinolaryngology, cardiology (excluding cardiac catheterization), pulmonary, allergy, neurology, chemotherapy, dermatology, and physical medicine. Echocardiography and Doppler peripheral flow studies are included here, regardless of the procedure code used. Finally, all corresponding "alpha" codes for these services are also included.

TABLE 2-3

CHANGES IN NUMBER OF PROVIDER IDs OVER TIME, 1983-1986

	1983	1984	1985	1986
Alabama	9,057	8,664	8,545	9,193
Connecticut	3,903	4,707	4,054	5,325
Washington	5,551	5,929	6,081	7,040
Wisconsin	5,364	5,252	5,224	2,216[a]

[a]The carrier changed its entire series of provider IDs beginning in this year.

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

provider IDs can increase over time not only because the supply of physicians is growing over time, but also because the number of practices is growing, independently of the number of physicians. It is not uncommon for the same physician(s) to have multiple provider IDs, one for each practice location. The number of provider IDs may fall, on the other hand, if individual physicians (with separate provider IDs) establish a new group. In other instances, the carrier may assign totally new IDs to providers, as Travelers did when it took over Part B in Connecticut.

In order to conduct our econometric analyses, it is clearly necessary to have a panel of observations throughout the time-series. Only a fraction of the provider IDs observed in 1986 were also found in the preceding years as well. Since it was impossible to construct a panel of physicians, we constructed a panel of areas. We aggregated claims to the area (reasonable charge locality) level and used this as the unit of observation, weighted by its Medicare beneficiaries (Part B enrollees).

2.4 Other Methodological Issues

2.4.1 Hospital Claims

Although data on Medicare inpatient days were available annually from secondary data sources, we felt that more precise measures of changing utilization rates were needed to separately capture PPS effects from those of the fee freeze. Beginning in October 1983, HCFA has produced 100 percent Medicare Part A claims data, known as the Medpar files. We used these data to construct admission rates, mean lengths of stay, and total inpatient days for each quarter and each locality in our four states. This allowed us to quantify the changes in inpatient utilization that occurred as each cohort of hospitals made the transition onto PPS.

Complete census data on hospital admissions were not available for the first nine months of our timeseries (January-September 1983). Prior to PPS, HCFA maintained a sample of Part A records based on a 20 percent sample of beneficiaries. We simply multiplied the utilization rates obtained from the sample data by five to obtain measures comparable to those available later.

2.4.2 Secondary Data Sources

Both descriptive and econometric analyses are performed with dependent variables (expenditures, volumes) expressed on a per beneficiary basis. Medicare beneficiaries were defined as all Part B enrollees; data were obtained by county and by year from HCFA.

The econometric analyses included a number of exogenous demand and supply factors as independent variables. These variables were defined for the county (and aggregated up to the reasonable charge locality) and included such

things as HMO penetration, physician-population ratios, inpatient days per capita, wage index, average per capita income, etc. Most were available from the Area Resource File, and others, like individual hospitals' PPS start dates, from HCFA's PPS Impact File. Chapter 4 describes the source for these variables in more detail.

2.4.3 Construction of Medicare Price Deflator

For the purposes of analyzing the effects of the freeze on real quantities, it was necessary to construct a price deflator calibrated to a standard market basket of Medicare physician services. Deflation of expenditure data by this deflator yields a measure of real expenditures or weighted quantity, a variable suitable for regression analysis.

We constructed this deflator at the level of the physician specialty. For each specialty, five common services were aggregated into that specialty's market basket. The specific services were chosen to reflect a range of types of service, e.g., visits, surgery, etc. Subsequently, in each quarter and locality (RCL) the average allowed charge of each of the specialty's five chosen units of service were measured. A weighted average price of the specialty's market basket for the RCL/quarter was then computed by weighting each of the five calculated prices by their average share of physician expenditures over the 16 quarter time frame. The result was a weighted average price of the specialty's market basket constructed at the level of the RCL/quarter. This weighted average price was then divided by the weighted average price of a four state weighted average price of specialty services, constructed in the base quarter (based on the same five services). This gave us a specialty-specific price index, which varied by RCL and quarter.

Of course, this same procedure was repeated for each of the physician specialties, thus giving a set of time-series and cross-section indices for each specialty. Using these indices we were able to deflate measured expenditures at the level of the physician specialty. When deflated in this manner, the expenditure measures become measures of weighted quantity, so that analysis can be done independent of price effects.

In addition, it is possible to aggregate the various price indices into a single overall price index suitable for deflating total expenditures. This was done by weighting each of the individual specialty price indices by its share of overall expenditures. The result is an overall index of Medicare prices which varies only by quarter. In theory, this index is based on a market basket of all Medicare Part B services, with each service (implicitly) weighted by its share of total expenditures.

3.0 DESCRIPTIVE ANALYSIS

3.1 Overview

In this chapter we present tabular data describing the increases in Part B physician expenditures (allowed charges) over the 1983-1986 period. We also examine changes in the volume of services, and in the shift in procedure code distribution (potential upcoding). In particular, we seek to answer the following questions:

- What has been the year to year increase in total Part B spending per beneficiary? By type of service? By specialty?
- Which procedures have been growing most rapidly? Who is performing them?
- Can we disentangle "real" volume effects, from those due to PPS and the elimination of combined billing?
- How has the location of service changed over time? In particular, what has been the relationship between hospital versus office visits?
- Is there any evidence of "upcoding"? If so, for what procedures? What has been its effect on total spending?
- Can we decompose the increase in expenditures by the source of the increase? How much is due to greater volume, and how much can be attributed to upcoding?

Data are first presented for the sixteen quarters between January 1983 and December 1986. All remaining tables use half-years rather than quarters, for greater readability. With a few exceptions, the tables are based on pooled data from all four states. The interested reader may refer to Appendix A for detailed data on the individual states.

Both expenditure and volume data are presented on a per beneficiary basis, so that any observed changes will have held increases in Part B enrollment constant. Quarterly expenditures are shown in both nominal and real terms. Real expenditures have been deflated using the Medicare price index described in Chapter 2. In all subsequent tables with half-years, the dollars are nominal allowed charges. In the econometric analyses that follow in Chapter 4, however, dollars are adjusted for real price changes over time and across regions.

3.2 Time Trends in Expenditures

3.2.1 Quarterly Trends in Nominal and Real Expenditures

Table 3-1 presents the Medicare Price Index, nominal expenditures (total allowed charges), and real expenditures per beneficiary. Changes in the Medicare Price Index reflect the two reasonable charge updates made during the 1983-1986 time period. The first was put into effect in July 1983 (quarter 3), and we observe an average increase of 7.1 percent (over quarter 1). Although generally stable during the fee freeze, there is some quarter to quarter fluctuation in the price index. This is simply due to the fact that the mix of physicians actually billing for services varies from quarter to quarter. The second update was made in May 1986 (quarter 14) and applied to participating physicians only, resulting in an average increase of 2.9 percent in allowed charges (1.105-1.074/1.074).

Per beneficiary spending increased steadily over the study time period. By the end of 1986, the Medicare program and its beneficiaries was spending 35.5 percent more for physician services than at the beginning of 1983. This amounted to almost $133 more during 1986 than three years previously ($132.71=$582.36-$449.65, summing the appropriate quarters for 1986 and 1983, respectively). Of course, almost one-third of this increase (11.2%/35.3%) was due to the reasonable charge updates during this period. The remaining two-thirds of the growth in spending, however, can be attributed to increases in the volume of physician services and to the substitution of more expensive for less expensive services. Real expenditures (in the third column of Table 3-1) provide a measure of quantity increases over the four years, netting out the price increases, and show a 21.9 percent increase.

Table 3-1 shows a marked reduction in expenditures for the third quarter of 1984 (quarter 7), of about 4 percent or $5 per beneficiary. Spending remains at this lower rate through the end of the calendar year, and then rebounds in 1985 to even higher levels than before. As will be seen in later tables, this mid-1984 reduction is observed for all four states and for every type of service.

Although the Medicare fee freeze went into effect July 1984, we cannot necessarily assume that the freeze was responsible for this (short-lived) decline in expenditures, because two other policies were being implemented at the same time: the direct billing requirement for lab tests and PPS. First, the direct billing policy prevented physicians from billing for laboratory tests they do not personally provide in their offices. Thus, we would expect physician lab expenditures to fall at this point in time. Since lab tests account for only a small proportion of total physician expenditures, however, this can be at best a partial explanation.

TABLE 3-1

MEDICARE PRICE INDEX, NOMINAL EXPENDITURES, AND PRICE-WEIGHTED QUANTITY PER BENEFICIARY, 1983-1986

Year/Quarter		Medicare Price Index	Nominal Expenditures/ Beneficiary	Weighted Quantity/ Beneficiary
1983	1	1.000	$109.15	$109.15
	2	1.007	111.81	110.03
	3	1.071	117.14	109.37
	4	1.067	111.55	104.55
1984	5	1.068	123.78	115.99
	6	1.072	123.20	114.93
	7	1.073	118.13	110.09
	8	1.072	118.39	110.44
1985	9	1.074	128.23	119.39
	10	1.078	134.66	124.92
	11	1.076	136.21	126.59
	12	1.076	132.72	123.35
1986	13	1.074	137.26	127.80
	14	1.105	149.44	135.24
	15	1.113	147.76	132.76
	16	1.112	147.90	133.00
% Change Q1-Q16		11.2%	35.5%	21.9%

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

Second, although hospitals began phasing into PPS in October 1983, a disproportionate share of hospitals came on in July 1984. This may have acted as a considerable "shock" to physician practice patterns. Nevertheless, the majority of hospitals had already come on prior to July 1, and many hospitals are believed to have engaged in considerable anticipatory behavior prior to PPS transition. More detailed examination of the expenditure reduction by type of service and by location of service may help shed light on the factors responsible.

3.2.2 Changes in Total Expenditures by State

Table 3-2 presents total (nominal) physician allowed charges over the 1983-1986 time period for each state separately and for the four states combined. Total charges based on the pooled data are identical to those in Table 3-1; they are simply shown here in half-years for greater readability. The percent changes are calculated on a calendar year basis, however, and will thus be somewhat lower than the quarterly percent changes shown in Table 3-1.

Although all four states exhibit increases in their Part B physician spending, there is considerable variation in the rates of increase across states, ranging from a relatively low 13.6 percent in Wisconsin to a high of 46.4 percent in Washington. The effect of Washington's rapid spending growth is to bring its per beneficiary expenditures to more comparable levels with other states. In 1983, for example, physician spending in Washington was lower than in any of the other three states ($416 per beneficiary compared with $443-$462 elsewhere). By 1986, however, Washington physician expenditures were virtually identical ($608 per beneficiary) to those in Alabama and Connecticut ($601 and $616, respectively). By contrast, spending levels in Wisconsin, while initially relatively high, failed to keep up; by 1986, absolute expenditures per beneficiary in Wisconsin were 13-15 percent lower than in the other three states.

3.2.3 Changes by Type of Service

Table 3-3 displays changes in expenditures per beneficiary for each of nine different types of service. As our definitions of type of service differ

TABLE 3-2

TOTAL MEDICARE PHYSICIAN EXPENDITURES PER BENEFICIARY BY STATE, 1983-1986

HALFYEAR	ALL STATES	ALABAMA	CONNECTICUT	WASHINGTON	WISCONSIN
JANUARY-JUNE 1983	$220.96	$220.40	$229.53	$205.65	$227.61
JULY-DECEMBER 1983	228.67	222.69	249.21	209.86	234.60
JANUARY-JUNE 1984	246.98	239.10	262.60	244.51	244.95
JULY-DECEMBER 1984	236.52	224.42	259.36	223.69	241.27
JANUARY-JUNE 1985	262.91	249.68	283.12	278.43	247.93
JULY-DECEMBER 1985	268.92	253.90	289.46	283.62	255.74
JANUARY-JUNE 1986	286.72	293.41	296.72	304.06	260.95
JULY-DECEMBER 1986	295.65	307.18	319.31	304.40	263.93
% CHANGE 1983-1984	7.5%	4.6%	9.0%	12.7%	5.2%
% CHANGE 1984-1985	10.0	8.6	9.7	20.0	3.6
% CHANGE 1985-1986	9.5	19.3	7.6	8.3	4.2
% CHANGE 1983-1986	29.5	35.5	28.7	46.4	13.6

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE 3-3

TOTAL MEDICARE PHYSICIAN EXPENDITURES PER BENEFICIARY BY TYPE OF SERVICE, 1983-1986

HALFYEAR	TOTAL	MED CARE	CONSULT	SURGERY	ANESTHESIA	ASST SURG	RADIOLOGY	LAB	SPECIAL TESTS	OTHER
JANUARY-JUNE 1983	$220.96	$75.32	$6.83	$75.72	$9.97	$5.73	$27.49	$8.05	$10.29	$1.56
JULY-DECEMBER 1983	228.67	75.67	7.11	79.67	10.72	5.78	28.20	8.29	10.77	2.45
JANUARY-JUNE 1984	246.98	80.20	7.71	86.89	11.76	6.66	30.64	8.55	12.05	2.51
JULY-DECEMBER 1984	236.52	75.64	7.18	85.83	11.30	6.45	29.13	6.51	12.10	2.37
JANUARY-JUNE 1985	262.91	83.44	8.00	94.42	12.28	7.23	33.15	6.95	14.31	3.12
JULY-DECEMBER 1985	268.92	81.66	8.23	99.58	12.60	7.19	34.03	7.61	14.90	3.12
JANUARY-JUNE 1986	286.72	86.87	8.88	103.01	13.20	6.77	37.21	8.06	16.95	5.78
JULY-DECEMBER 1986	295.65	87.85	9.11	107.26	13.62	6.75	38.74	8.07	18.17	6.07
% CHANGE 1983-1984	7.5%	3.2%	6.8%	11.2%	11.5%	13.9%	7.3%	-7.8%	14.7%	21.7%
% CHANGE 1984-1985	10.0	5.9	9.0	12.3	7.9	10.0	12.4	-3.3	21.0	27.9
% CHANGE 1985-1986	9.5	5.8	10.8	8.4	7.8	-6.2	13.1	10.8	20.2	89.9
% CHANGE 1983-1986	29.5	15.7	29.1	35.3	29.6	17.5	36.4	-1.3	66.8	195.5

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

Somewhat from those used by HCFA,* we will describe each briefly first. (For more detail, the reader is referred to Table 2-2 in Chapter 2.)

- medical care - visits of all types (except consultations) and dialysis services;
- consultations - self-explanatory;
- surgery - all diagnostic and therapeutic surgical procedures, including cardiac catheterization;
- anesthesia - all anesthesia services;
- assistant surgery - all assistant surgery;
- radiology - all x-ray services except Doppler studies and echocardiography;
- laboratory - all pathology and laboratory services provided by physicians, including the handling fees;
- specialized tests - all specialized tests and services included in the 90000 series of CPT-4, plus Dopplers and echocardiography;
- other services - physician services not classifiable elsewhere, because the carrier used its own coding system (primarily different kinds of tests).

All types of service, except laboratory tests, show a substantial increase over the 1983-1986 time period. The fastest growing services are the specialized tests: spending per beneficiary for these have increased 67 percent over the four years in our four states. (We ignore for now the "other" category, since its content is largely unknown.) Consultations, surgery, radiology, and anesthesia have all increased by about a third, while medical care and assistant surgery have risen at only half that rate. Let us discuss each type of service in more detail individually.

Expenditures on medical care, which primarily consists of visits, has risen relatively modestly: 3 percent from 1983 to 1984, and then 6 percent a year thereafter. We would expect that inpatient visits would have fallen during this time period due to PPS, with an offsetting increase in office visits. Since the net change is positive, however, there may be more than a simple one-to-one substitution of office for hospital visits. (Medical care also includes visits in other settings, such as nursing homes, emergency rooms, and intensive care units, but these account for a relatively small proportion of total medical care dollars.) We will examine possible changes in the mix of visits later in Section 3.4.

Over the four year period, expenditures on consultations have been growing at ever increasing rates. In 1983, consultations averaged $14 per beneficiary; by 1986, it was $18. Consults can be considered a kind of visit,

*We re-categorized procedures into these nine type of service groupings in order to have comparable definitions across carriers and over time.

in many ways a substitute for a comprehensive initial visit. In our analysis of changes in the mix and volume of visits over time, we will also include consultations.

Because surgery is the single largest type of service, accounting for more than one-third of the Medicare physician dollar, increases in spending here have a disproportionate impact on total Medicare outlays. Expenditures on surgical services increased 35 percent from 1983-1986, adding about $55 to the "cost" of care for every enrollee, far more than any other kind of service. Increases in spending may be due to more operations and/or to a shift in the mix of procedures, i.e. more expensive operations. We will look in detail at specific surgeries in Section 3.5.

If surgical expenditures rise, then spending on anesthesia services can not be far behind. Expenditures on anesthesia rose fairly steadily over the time period, but not quite as rapidly as surgery (30% over four years versus 35%). This probably is due to the fact that many surgeries, especially diagnostic procedures like endoscopies, do not require anesthesia.

Similarly, from 1983 to 1985, spending increased fairly rapidly for assistant surgery. Then in 1986, per beneficiary expenditures actually fell more than 6 percent from the previous year's levels. Analysis of the claims data revealed that this was almost entirely due to a sharp reduction in the use of assistant surgeons during cataract surgery. (Mandatory prepayment screens for assistants at lens procedures were implemented at this time.)

Spending for radiology services rose 36 percent, increasing from $56 per beneficiary in 1983 to $76 in 1986. As with surgery, this may reflect a combination of both more x-rays and more expensive ones, such as CAT scans and magnetic resonance imaging. Increased expenditures for radiology services does not necessarily mean that there has been a large increase in "true" volume. Instead, the substitution of "complete procedure" for "interpretation only" bills may have led to a real increase in the number of Part B bills and an apparent increase in the number of x-rays performed.

The dilemma, for both researchers and policy-makers, is how to disentangle real versus apparent growth in volume. While hospitals may have begun to shift x-rays from inpatient to outpatient settings during the first year of PPS, these changes may have been continuing over the course of the study period. Certainly, radiology expenditures have continued to increase. In later sections, we will examine shifts in the location of radiology services over time (Section 3.3) and in the mix of x-rays provided (Section 3.6).

Spending on laboratory tests shows a small net decline over the four year time period, with a major reduction beginning in July 1984.* As discussed above, this is when the direct billing requirement was implemented, prohibiting physician billing for lab services that they do not personally perform. After the initial "dislocation" in 1984, however, lab spending began to rise again, and by 1986 had approached its initial levels. It is widely believed that physicians have since expanded their in-office testing capability (see Eisenberg et al., 1987). Thus, the short-term decline in lab expenditures observed during 1983-1986 probably will not persist over the long-run.

As noted earlier, spending on specialized tests grew at a faster rate than any other type of service (except the residual non-classifiable category). Specialized tests include a wide range of services such as pulmonary function tests, allergy testing, EEGs, etc., but cardiac services account for the majority of expenditures. Cardiac services include routine ECGs, rhythm ECGs, cardiovascular stress tests, Holter monitors, echocardiography, and the like. (They do not include cardiac catheterization which is grouped with surgery.) Most of these services are subject to the same billing constraints; only the less expensive "interpretation only" bills are permitted in the hospital and OPD settings. If these tests are increasingly being provided in physicians' offices, then many bills may include both the technical and interpretive aspects of the tests. Thus, like radiology services, some of the increase in expenditures may be more apparent than real.

Finally, expenditures per beneficiary in the "other" category tripled over the four year period. Although the absolute dollars are relatively small, these "other" services increased as a percent of total expenditures from less than one percent in 1983 to 2 percent in 1986. It would appear that carriers have added more carrier-specific HCPCS codes over time and/or have encouraged more physicians to use them. (All four states show high rates of increase.) It is unfortunate that we do not exactly what these services are, but we can rule out surgery, assistant surgery, and anesthesia (because of the way in which we developed our type of service classification). Since it is unlikely that carriers would need to add visit codes, we suspect that this "other" category is composed primarily of radiology and specialized tests.

As mentioned earlier, spending on almost every type of service shows a marked drop during the second half of 1984. From Table 3-3, we see that medical care and lab tests are responsible for most of the $10.46 reduction ($236.52 - $246.98): $4.56 and $2.04, respectively. It seems reasonable to assume that the drop in physician lab test spending was due to the direct

*Recall that laboratory services here refer only to those billed by physicians. Independent laboratories are excluded from our analysis.

billing requirement, but why medical care expenditures should fall so sharply is less clear. Since this type of service is primarily composed of hospital and office visits, disaggregation by the setting of care may help. In Section 3.3.3, we decompose the 1984 drop by both service type and location.

3.2.4 Decomposition of Increase by Service Type

We saw in the preceding section that nominal expenditures per beneficiary increased by $132.74 from 1983 to 1986. While we know that virtually all types of service contributed to this growth, we would like to know how much of the added spending can be attributed to surgery, how much to specialized tests, etc.

Table 3-4 decomposes the increase into its component sources by service type. The percent distribution sums to 100 percent. For comparison, we also include each service type's share of total expenditures. The relative contribution of each type of service to the growth in expenditures is a function both of its rate of increase over the time period and its relative size to begin with. Although spending on consultations grew by 29 percent from 1983 to 1986, for example, consultations only accounted for 3 percent of the Medicare physician dollar.

Increased spending on surgical procedures is by far the most important factor; over 40 percent of the increase in physician expenditures can be attributed to surgery. Increased surgical volume, and a shift toward a more expensive mix of operations, undoubtedly both play a role. Examples of changes in the operative mix would include performing more endoscopies with biopsies (diagnostic endoscopies without biopsies are less expensive), or bypassing more obstructions during CABG surgery (reimbursement usually increases with each additional graft). Later in Section 3.5, we will examine the "growth" procedures, those operations that are contributing most to the surgical spending increases. The econometric analysis in Chapter 6 will separate volume from procedure mix effects.

Medical care and radiology each account for approximately one-sixth of the expenditure growth. Increased spending for specialized tests is responsible for almost 11 percent. It is noteworthy that only 5 percent of the Medicare physician dollar was spent on these tests in 1986; they are contributing far more than their "fair share" to the Part B increases. The remaining types of service account for a relatively small amount of the increase.

3.3 Time Trends in Location of Service

The introduction of PPS has resulted in a re-distribution of many physician services, especially tests, out of the hospital and into ambulatory settings. It also reinforced a growing secular trend to perform outpatient

TABLE 3-4

SOURCES OF INCREASE IN PER BENEFICIARY SPENDING FOR PHYSICIANS' SERVICES, 1983-86

Type of Service	Percent of Increase	Percent of Total Expenditures
Medical Care	17.9%	31.6%
Consultations	3.0	3.1
Surgery	41.3	35.8
Anesthesia	4.6	4.7
Assistant Surgery	1.5	2.6
Radiology	15.3	12.6
Laboratory	-0.1	3.0
Specialized Tests	10.6	5.3
Other	5.9	1.3
	100.0%	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

surgery. Understanding these changes is a necessary background to understanding expenditure growth more generally. Expenditures for x-rays and specialized tests are expected to increase due to PPS, but only to the extent they are shifted from the hospital and into the physician's office. The technical component of tests performed in the hospital outpatient department continue to be billed through Part A.

3.3.1 Changes in Expenditure Share By Setting

Table 3-5 presents a frequency distribution of total physician expenditures across settings: office, inpatient hospital, outpatient department (OPD) or ambulatory surgical center (ASC)*, SNF or other nursing home, patient's home, and other (such as a laboratory). The rows sum to 100 percent. As expected, there has been a dramatic shift away from the hospital and into ambulatory settings. The share of the Medicare physician dollar spent in the hospital fell from two-thirds in 1983 to less than half in 1986. About 10 points of that 15 percentage point decline was made up in OPDs and ASCs, where the expenditure share tripled over the four year period. The remaining 5 points was spent in the office. In 1986, about 33 cents of the Medicare physician dollar was spent in the office, up from 29 cents in 1983. The relative expenditure shares for nursing homes and other settings, all small to begin with, remained unchanged.

The timing of the shift from inpatient to outpatient settings emphasizes the important role of PPS in understanding the allocation of physician expenditures. Part B spending in the hospital fell most markedly between January 1984 and January 1985; this was the period during which the vast majority of hospitals first began receiving DRG-based payments. In Section 3.3.2 below, we examine changes in actual expenditures per beneficiary in the hospital and other settings.

Table 3-6 presents a similar frequency distribution, but just for total surgical expenditures across settings: office, inpatient hospital, OPD/ASC, and all other. As expected, there has been a major shift of surgical procedures away from the hospital and into other settings, primarily OPDs and ASCs. In 1983, 85 cents of every Medicare surgical dollar was spent in the hospital; by 1986, only 60 cents went toward inpatient surgery. Again, inpatient spending fell most rapidly from 1984 to 1985, as hospitals came onto PPS.

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*Unfortunately, carrier coding by location of service did not allow us to examine these two settings separately.

TABLE 3- 5

PERCENT DISTRIBUTION OF TOTAL MEDICARE PHYSICIAN EXPENDITURES BY LOCATION OF SERVICE, 1983-1986

HALFYEAR	OFFICE	INPATIENT	OPD/ASC	SNF/NH	HOME	OTHER SETTINGS	TOTAL
JANUARY-JUNE 1983	28.6%	63.7%	5.4%	1.3%	0.8%	0.3%	100%
JULY-DECEMBER 1983	29.3	62.4	5.7	1.4	0.8	0.5	100
JANUARY-JUNE 1984	29.4	61.1	6.8	1.4	0.8	0.6	100
JULY-DECEMBER 1984	30.5	57.7	9.2	1.4	0.8	0.5	100
JANUARY-JUNE 1985	31.4	54.0	11.9	1.4	0.8	0.4	100
JULY-DECEMBER 1985	32.3	51.2	14.0	1.4	0.7	0.4	100
JANUARY-JUNE 1986	32.9	50.0	14.7	1.4	0.6	0.4	100
JULY-DECEMBER 1986	33.6	48.1	16.1	1.4	0.4	0.3	100

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE 3- 6

PERCENT DISTRIBUTION OF EXPENDITURES FOR SURGERY BY LOCATION OF SERVICE, 1983-1986

HALFYEAR	OFFICE	INPATIENT	OPD/ASC	OTHER SETTINGS	TOTAL
JANUARY-JUNE 1983	9.3%	85.4%	4.6%	0.7%	100%
JULY-DECEMBER 1983	9.9	84.1	5.3	0.8	100
JANUARY-JUNE 1984	9.5	82.2	7.4	0.9	100
JULY-DECEMBER 1984	10.7	76.4	12.0	0.9	100
JANUARY-JUNE 1985	10.7	70.1	18.3	0.9	100
JULY-DECEMBER 1985	12.0	65.2	21.8	0.9	100
JANUARY-JUNE 1986	12.4	63.1	23.5	1.0	100
JULY-DECEMBER 1986	13.1	60.0	25.7	1.1	100

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

The shift in testing from inpatient to outpatient settings is illustrated in Table 3-7 for radiology services.* This is largely (if not wholly) a PPS phenomenon. Inpatient expenditures for x-rays have shrunk from over 55 percent of total radiology expenditures in 1983 to about 40 percent in 1986. The relative shares for offices and OPDs have increased at virtually identical rates, from 20 percent each to 30 percent each.

Finally, Table 3-8 presents similar results for specialized tests. Roughly two-thirds of expenditures are for tests performed in the physician's office, with a slight increase over time. As expected, the share provided in the hospital has fallen, presumably due to PPS.

3.3.2 Changes in Total Expenditures by Location

Shifts in the expenditure shares by location of service may mask the actual rates of growth in different settings. Table 3-9 presents spending per beneficiary for each of the settings shown earlier in Table 3-5. Expenditures in outpatient departments and ambulatory surgical centers have quadrupled during the 1983-1986 period. While spending on physician services in their offices has "only" grown 49 percent, it is worth noting that the absolute dollar increases from 1983 to 1986 were comparable in both ambulatory settings: about $65 more per beneficiary in the OPD and $63 more in the office.

Although inpatient expenditures have shrunk as a percent of total physician spending, the actual dollars remained virtually unchanged. The Medicare program and its beneficiaries spent about the same amount on inpatient services in 1986 as they did in 1983.

Earlier, Medicare physician expenditures were shown to have dropped abruptly during the July-September quarter of 1984, remaining low through the end of the year. From Table 3-9, we observe that the reduction took place entirely in the hospital setting. In fact, if it were not for a partially offsetting increase in the OPD, the spending drop would have been even larger. (The reduction in lab test expenditures apparently was completely offset by increases for other office-based services.) This strongly suggests that changing physician practice patterns due to PPS were responsible for this one-time drop in Part B expenditures. In the next section, we decompose the reduction to determine what specific services had decreased.

*This table is limited to those radiology services provided by radiologists. Radiologists account for 72 percent of all Medicare expenditures on radiology.

TABLE 3-7

PERCENT DISTRIBUTION OF EXPENDITURES FOR RADIOLOGY BY LOCATION OF SERVICE, 1983-1986

HALFYEAR	OFFICE	INPATIENT	OPD/ASC	TOTAL
JANUARY-JUNE 1983	20.3%	57.7%	21.9%	100%
JULY-DECEMBER 1983	21.3	55.4	23.3	100
JANUARY-JUNE 1984	22.7	52.9	24.3	100
JULY-DECEMBER 1984	23.8	48.6	27.6	100
JANUARY-JUNE 1985	24.6	46.2	29.2	100
JULY-DECEMBER 1985	25.9	43.1	31.0	100
JANUARY-JUNE 1986	27.3	41.1	31.6	100
JULY-DECEMBER 1986	30.3	38.0	31.6	100

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE 3-8

PERCENT DISTRIBUTION OF EXPENDITURES FOR SPECIALIZED TESTS BY LOCATION OF SERVICE, 1983-1986

HALFYEAR	OFFICE	INPATIENT	OPD/ASC	OTHER SETTINGS	TOTAL
JANUARY-JUNE 1983	62.4%	29.6%	4.6%	3.4%	100%
JULY-DECEMBER 1983	65.0	27.2	4.5	3.3	100
JANUARY-JUNE 1984	65.9	24.9	5.7	3.4	100
JULY-DECEMBER 1984	67.4	22.5	6.4	3.8	100
JANUARY-JUNE 1985	67.8	21.9	6.4	3.8	100
JULY-DECEMBER 1985	68.2	21.0	6.7	4.1	100
JANUARY-JUNE 1986	66.4	22.0	7.0	4.6	100
JULY-DECEMBER 1986	65.0	22.6	7.7	4.7	100

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE 3-9

TOTAL MEDICARE PHYSICIAN EXPENDITURES PER BENEFICIARY BY LOCATION OF SERVICE, 1983-1986

HALFYEAR	OFFICE	INPATIENT	OPD/ASC	SNF/NH	HOME	OTHER SETTINGS	TOTAL
JANUARY-JUNE 1983	$63.16	$140.67	$11.84	$2.87	$1.70	$0.73	$220.96
JULY-DECEMBER 1983	67.10	142.70	12.94	3.16	1.74	1.04	228.67
JANUARY-JUNE 1984	72.54	150.91	16.68	3.49	1.88	1.49	246.98
JULY-DECEMBER 1984	72.08	136.42	21.74	3.25	1.89	1.15	236.52
JANUARY-JUNE 1985	82.59	141.89	31.39	3.75	2.16	1.13	262.91
JULY-DECEMBER 1985	86.94	137.58	37.57	3.72	1.94	1.16	268.92
JANUARY-JUNE 1986	94.22	143.35	42.28	3.90	1.73	1.25	286.72
JULY-DECEMBER 1986	99.48	142.31	47.46	4.26	1.24	0.90	295.65
% CHANGE 1983-1984	11.0%	1.4%	55.0%	11.8%	9.6%	49.2%	7.5%
% CHANGE 1984-1985	17.2	-2.7	79.5	10.8	8.8	-13.3	10.0
% CHANGE 1985-1986	14.3	2.2	30.1	9.2	-27.6	-6.1	9.5
% CHANGE 1983-1986	48.7	0.8	262.1	35.3	-13.7	21.5	29.5

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

3.3.3 Decomposition of the 1984 Spending Reduction

We know from Table 3-3 that the spending drop was most pronounced for two types of service, medical care and lab tests, and from Table 3-9 that a net reduction was observed for only one location: in the hospital. Table 3-10 decomposes the 1984 reduction by service type and summarizes the offsetting effects of shifts in the locus of care. Although spending on inpatient surgery and radiology fell precipitously during the second half of 1984, this was largely offset by increased outlays in ambulatory settings (especially for surgery). The reduction in medical care expenditures during this period was entirely due to hospital visits; spending on routine hospital visits fell 48 percent, with little in the way of offsetting increases for office visits.*

The fact that this 1984 drop in spending was largely due to inpatient services, particularly hospital visits, suggests that a corresponding change in hospital utilization must have taken place at the same time. If so, then Medicare hospital claims data for 1984 should also document an abrupt change beginning in the third quarter of 1984. Table 3-11 presents quarterly changes in admission rates, lengths of stay, and total hospital days during 1984 for our four study states. While all three measures of inpatient utilization declined over the course of the year, admission rates fell markedly in the third quarter and continued to fall in the fourth quarter.

Examination of admission rates by DRG showed that the decline was concentrated in hospitalizations for lens surgery and for certain medical conditions (some of which are also shown in Table 3-11). These medical DRGs are ones in which there may be considerable discretion in the physician's decision whether to admit for treatment or to care for the condition on an ambulatory basis. Consider congestive heart failure, for example. Treatment usually consists of increased diuresis, bed rest, stricter salt and fluid restrictions, and (perhaps) oxygen. Most of this therapy can be performed easily at home; for many patients, the only reason to treat them as inpatients is to be able to monitor therapy and compliance, follow diuresis with daily weights, and to adjust medications as necessary.

How can we explain this abrupt drop beginning in the third quarter of 1984, given that the transition to PPS had begun in October 1983? There are probably two possible explanations. First, a disproportionate number of hospitals did not come on until July 1984 (representing over 32 percent of total beds in our four states). Second, the PROs, who are responsible for defining unnecessary admissions, were not all up and running when the first wave of hospitals started under PPS.

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*Office visit rates did increase to substitute for hospital visits, but with a lag. As will be seen in Section 3.4, total visits regained pre-July 1984 levels by early 1985.

TABLE 3-10

DECOMPOSITION OF THE 1984 DROP IN MEDICARE SPENDING PER BENEFICIARY

Medical Care	**-43.6%**
Hospital Visits	-45.7
Office Visits	2.1
Lab Tests	**-19.5**
Radiology	**-14.4**
Inpatient	-19.2
OPD	4.8
Office	0.0
Surgery	**-10.1**
Inpatient	-55.5
OPD	36.7
Office	8.7
Consultations	**-5.1**
Anesthesia	**-4.4**
Assistant Surgery	**-2.0**
Specialized Tests	**0.0**
Other	**-0.9**
	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington, and Wisconsin.

TABLE 3-11

QUARTERLY CHANGES IN ADMISSION RATES AND LENGTHS OF STAY, CALENDAR YEAR 1984

	Quarter				Percent Change
All Cases	1	2	3	4	Q1 - Q4
Total Admissions (per 1,000)	92.5	88.5	79.8	72.5	-21.6%
Mean Length of Stay (days)	9.5	9.1	8.9	8.3	-12.6
Inpatient Days (per 1,000)	878.7	805.0	710.5	601.3	-31.6
Specific DRGs					
Lens Procedures (DRG 39) Admissions Per 1,000	3.27	3.39	2.67	1.50	-54.1
Chronic Obstructive Pulmonary Disease (DRG 88) Admissions Per 1,000	1.95	1.76	1.22	1.08	-44.6
Pneumonia (DRG 89) Admissions Per 1,000	3.09	2.53	1.66	1.56	-49.5
Congestive Heart Failure (DRG 127) Admissions Per 1,000	4.17	4.06	3.42	3.55	-14.9
Misc. Digestive Disorders (DRG 182) Admissions Per 1,000	3.34	3.25	2.79	2.26	-32.3

Source: Medpar (Part A) claims for Alabama, Connecticut, Washington, and Wisconsin, 1984.

Declining admission rates may explain the drop in Part B inpatient spending, but why is there also a net drop in total physician spending? The answer is probably that the substitution of ambulatory for hospital services occurred with a lag. As seen in Table 3-1 above, total spending had exceeded pre-July 1984 levels by the first quarter of 1985. Thus, the 1984 drop represents only a short-run dislocation in physician practice patterns due to PPS.

3.4 Time Trends in Visit Volume

Although medical care expenditures showed relatively modest increases over the 1983-1986 time period, expenditures for different types of visits may have changed at varying rates. In particular, we would expect a decline in hospital visits and a corresponding increase in office visits, as PPS reduces admissions and shortens hospital stays. Table 3-12 displays the number of visits per beneficiary, separately by type of visit: office, hospital, other (nursing home, emergency room, and home visits), and consultations. Although technically not considered visits, consultations are similar to, and may substitute for, comprehensive new patient visits. The final column in Table 3-12 is the total sum of all visit types, including consultations.

As expected, there has been a definite substitution of office for hospital visits. The average beneficiary made 2.9 office visits and 2.9 hospital visits in 1983 (summing the two half-years); by 1986, he(she) saw the physician 3.5 times in the office and received 2.3 visits in the hospital. Note that the substitution has been perfectly offsetting; the total number of office and hospital visits per enrollee has not changed over the time period. The average beneficiary received 5.8 office and hospital visits, both in 1983 (2.9 + 2.9), and in 1986 (3.5 + 2.3). Visits in other settings and consultations have also increased over time, however, so that total physician contacts show a net gain over time. We see that while total visits definitely declined in the second half of 1984 (in response to the introduction of PPS), the net change over the entire time period was positive: from 7.0 to 7.2 visits per beneficiary, or an increase of over 2 percent.

Total outlays for visits and consultations increased almost 17 percent over the same time period, however, as we see from Table 3-13. (This table is identical in format to Table 3-12, except here we show expenditures per beneficiary, rather than number of visits.) While the Medicare program and its beneficiaries enjoyed 21 percent more office visits in 1986 than in 1983, they paid 36 percent more for them. Similarly, while hospital visit rates declined 22 percent over the time period, spending fell only 7 percent.

How can expenditures increase so much more rapidly than volume, especially when fees were frozen for most of this period? One possible explanation is a change in procedure code mix; physicians may be billing more expensive visit codes than previously. This could be the result of deliberate

TABLE 3-12

NUMBER OF PHYSICIAN VISITS PER BENEFICIARY BY TYPE OF VISIT, 1983-1986

HALFYEAR	OFFICE	HOSPITAL	OTHER VISITS	CONSULTS	TOTAL
JANUARY-JUNE 1983	1.48	1.53	0.49	0.11	3.61
JULY-DECEMBER 1983	1.45	1.38	0.48	0.11	3.42
JANUARY-JUNE 1984	1.54	1.41	0.51	0.12	3.58
JULY-DECEMBER 1984	1.52	1.18	0.50	0.11	3.32
JANUARY-JUNE 1985	1.66	1.24	0.56	0.12	3.59
JULY-DECEMBER 1985	1.68	1.13	0.56	0.13	3.49
JANUARY-JUNE 1986	1.76	1.18	0.55	0.14	3.63
JULY-DECEMBER 1986	1.77	1.08	0.57	0.14	3.57
% CHANGE 1983-1984	4.4%	-11.0%	4.1	4.5%	-1.8%
% CHANGE 1984-1985	9.2	-8.5	10.9	8.7	2.6
% CHANGE 1985-1986	5.7	-4.6	0.0	12.0	1.7
% CHANGE 1983-1986	20.5	-22.3	15.5	27.3	2.4

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE 3-13

MEDICARE EXPENDITURES PER BENEFICIARY FOR PHYSICIAN VISITS, 1983-1986

HALFYEAR	OFFICE	HOSPITAL	OTHER VISITS	CONSULTS	TOTAL
JANUARY-JUNE 1983	$27.35	$33.83	$12.13	$6.83	$80.13
JULY-DECEMBER 1983	28.68	33.50	12.17	7.11	81.45
JANUARY-JUNE 1984	30.69	34.72	13.56	7.71	86.68
JULY-DECEMBER 1984	30.91	29.94	13.48	7.18	81.52
JANUARY-JUNE 1985	34.27	31.83	15.43	8.00	89.53
JULY-DECEMBER 1985	35.12	29.40	15.23	8.23	87.99
JANUARY-JUNE 1986	37.42	31.90	15.59	8.88	93.79
JULY-DECEMBER 1986	38.75	30.72	16.49	9.11	95.07
% CHANGE 1983-1984	9.9%	-4.0%	11.3%	6.8%	4.1%
% CHANGE 1984-1985	12.6	-5.3	13.4	9.0	5.5
% CHANGE 1985-1986	9.8	2.3	4.6	10.8	6.4
% CHANGE 1983-1986	35.9	-7.0	32.0	29.1	16.9

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

"upcoding" by physicians, or of real changes in average visit complexity. Another possibility is a shift toward more expensive physicians, as specialists provide increasingly more visits, and GPs correspondingly fewer. (Most carriers recognize specialty differentials in their payment screens.) We will examine the actual shift in distribution of office and hospital visit codes in Section 3.7.

3.5 Time Trends in Surgical Procedures

Increased spending on surgery is the single most important factor in increased expenditure growth. What procedures are increasing most rapidly? Can we identify a handful of operations that appear to be most responsible for the increase in expenditures, or is it that volume is increasing for all surgical procedures? We selected a number of surgeries commonly performed on the Medicare population, and examined their rates of increase, both in terms of quantity and expenditures.

3.5.1 Cardiovascular Procedures

Table 3-14 presents four cardiovascular procedures: CABG surgery, transvenous pacemaker insertion, carotid thromboendarterectomy, and cardiac catheterization procedures. The top half of the table shows changes in the number of procedures per 1,000 beneficiaries over time, and the second half shows the corresponding changes in per beneficiary expenditures.

Rates of CABG surgery have increased steadily; (the small decline from 1983 to 1984 is insignificant). By 1986, CABG volume was 19 percent greater than in 1983.

There has been a steady decline in the number of pacemakers inserted, down more than one-quarter from 1983 levels. This pattern was observed in three of our four states; Washington showed little change. A growing awareness that many pacemakers are not medically necessary may be one explanation (most recently, see Greenspan et al., 1988). Similarly, rates for carotid thromboendarterectomy fall markedly in 1986 after having risen steadily during 1983-1985. The identical pattern was observed in all four states. This procedure has been the subject of growing criticism regarding its clinical effectiveness, and surgeons appear to be responding by curtailing its use (see, for example, Matchar and Pauker, 1987).

The number of cardiac catheterizations performed per Medicare beneficiary have almost doubled from 1983 to 1986. We suspect that this procedure was frequently billed by hospitals prior to TEFRA, especially in teaching hospitals. Thus, apparent increases in utilization may simply be increases in Part B bills. However, combined billing should have been eliminated by 1984 at the latest; yet we observe a 15 percent growth rate from 1985 to 1986.

TABLE 3-14

NUMBER OF AND MEDICARE PHYSICIAN EXPENDITURES FOR SELECTED CARDIOVASCULAR PROCEDURES, 1983-1986

NUMBER OF OPERATIONS PER 1000 BENEFICIARIES

HALFYEAR	CABG	PACEMAKER	THROMBOENDARTERECTOMY	CARDIAC CATHERIZATION
JANUARY-JUNE 1983	1.34	1.22	0.72	2.69
JULY-DECEMBER 1983	1.34	1.22	0.92	2.60
JANUARY-JUNE 1984	1.30	1.07	1.00	3.48
JULY-DECEMBER 1984	1.27	0.95	0.94	3.32
JANUARY-JUNE 1985	1.39	1.06	1.04	4.13
JULY-DECEMBER 1985	1.52	0.96	1.02	4.37
JANUARY-JUNE 1986	1.57	0.88	0.78	4.78
JULY-DECEMBER 1986	1.63	0.88	0.71	5.01
% CHANGE 1983-1984	-4.1%	-17.2%	18.3%	28.5%
% CHANGE 1984-1985	13.2	0.0	6.2	25.0
% CHANGE 1985-1986	10.0	-12.9	-27.7	15.2
% CHANGE 1983-1986	19.4	-27.9	-9.1	85.1

EXPENDITURES PER BENEFICIARY

HALFYEAR	CABG	PACEMAKER	THROMBOENDARTERECTOMY	CARDIAC CATHERIZATION
JANUARY-JUNE 1983	$4.10	$0.98	$0.90	$1.05
JULY-DECEMBER 1983	4.32	0.99	1.17	1.08
JANUARY-JUNE 1984	4.24	0.91	1.29	1.42
JULY-DECEMBER 1984	4.14	0.79	1.22	1.37
JANUARY-JUNE 1985	4.72	0.85	1.29	1.74
JULY-DECEMBER 1985	5.03	0.80	1.26	1.82
JANUARY-JUNE 1986	5.32	0.77	1.03	2.06
JULY-DECEMBER 1986	5.67	0.81	0.96	2.25
% CHANGE 1983-1984	-0.5%	-13.7%	21.3%	31.0%
% CHANGE 1984-1985	16.3	-2.9	1.6	27.6
% CHANGE 1985-1986	12.7	-4.2	-22.0	21.1
% CHANGE 1983-1986	30.5	-19.8	-3.9	102.3

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

Expenditure trends for these procedures follow those for volume, but generally increase at faster rates (except for procedures whose rates are falling, here expenditures decrease at slower rates). Utilization rates for CABG surgery, for example, have increased 19 percent from 1983 to 1986 but spending on these operations has risen more than 30 percent. Since fees were frozen for most of this time period, expenditures can rise faster than volume only if the mix of operations has become more expensive.

3.5.2 Orthopedic Surgeries and Lens Procedures

Table 3-15 presents similar data for three orthopedic procedures and for lens procedures. The orthopedic procedures are total hip replacement, total knee replacement, and femoral fractures requiring internal fixation. Lens procedures include intra- and extracapsular cataract extraction, one-stage procedures (extraction plus IOL insertion), and insertion of the intra-ocular lens subsequent to extraction.

Both joint procedures increase considerably in volume from 1983 through 1985, and then fall in 1986. The drop in hip and knee replacements occurs only in Connecticut and Wisconsin; the other two states show modest increases. Because these first two states have higher absolute rates of joint surgery, however, their changes in volume dominate the pooled four-state data. Spending on joint replacements does not fall in 1986, although its rate of increase is slowed considerably.

As expected, the surgical rate for femoral fractures remained more or less unchanged over the 1983-1986 time period. The utilization rate for this procedure is expected to vary as a function of falls and other accidents, but should be insensitive to changes in reimbursement variables. Femoral fractures serve as a good control; the modest 8.7 percent increase in spending per beneficiary reflects the very small net increase in volume (2.3%) as well as the fee updates that took place during this time period.

The volume increase in lens procedures is dramatic, jumping 50 percent over the time period. Rates of increase ranged from 32 percent in Connecticut to 76 percent in Washington. In 1983, spending on cataract surgery averaged $22.66 for every enrollee; by 1986, the Medicare program and its beneficiaries were spending $36.55, a staggering increase of 61 percent. Most of this expenditure growth can be attributed to increases in utilization, but some may be due to changes in the mix of lens procedures, particularly a substitution of one-stage for extraction-only operations.

3.5.3 General Surgical Procedures and Prostate Operations

Volume and expenditure data are shown for four surgical procedures in Table 3-16: cholecystectomy, partial colectomy, inguinal hernia repair, and transurethral resection of the prostate (TURP). The first three are typically

TABLE 3- 15

NUMBER OF AND MEDICARE PHYSICIAN EXPENDITURES FOR SELECTED ORTHOPEDIC AND LENS PROCEDURES, 1983-1986

NUMBER OF OPERATIONS PER 1000 BENEFICIARIES

HALFYEAR	HIP REPLACEMENT	KNEE REPLACEMENT	FEMORAL FRACTURE	LENS PROCEDURES
JANUARY-JUNE 1983	0.97	0.51	1.96	8.54
JULY-DECEMBER 1983	0.97	0.53	1.98	8.95
JANUARY-JUNE 1984	1.03	0.63	2.01	10.02
JULY-DECEMBER 1984	1.00	0.65	2.06	10.56
JANUARY-JUNE 1985	1.16	0.75	2.11	11.88
JULY-DECEMBER 1985	1.17	0.78	2.14	13.06
JANUARY-JUNE 1986	1.05	0.72	2.00	12.68
JULY-DECEMBER 1986	1.02	0.72	2.03	13.53
% CHANGE 1983-1984	4.6%	23.1%	3.3%	17.7%
% CHANGE 1984-1985	14.8	19.5	4.4	21.2
% CHANGE 1985-1986	-11.2	-5.9	-5.2	5.1
% CHANGE 1983-1986	6.7	38.5	2.3	49.9

EXPENDITURES PER BENEFICIARY

HALFYEAR	HIP REPLACEMENT	KNEE REPLACEMENT	FEMORAL FRACTURE	LENS PROCEDURES
JANUARY-JUNE 1983	$1.78	$0.96	$2.04	$10.59
JULY-DECEMBER 1983	1.90	1.02	2.20	12.07
JANUARY-JUNE 1984	2.04	1.21	2.24	13.68
JULY-DECEMBER 1984	1.94	1.25	2.29	14.46
JANUARY-JUNE 1985	2.08	1.42	2.36	16.04
JULY-DECEMBER 1985	2.14	1.43	2.38	17.56
JANUARY-JUNE 1986	2.11	1.43	2.27	17.59
JULY-DECEMBER 1986	2.13	1.51	2.34	18.96
% CHANGE 1983-1984	8.2%	24.2%	6.8%	24.2%
% CHANGE 1984-1985	6.0	15.9	4.6	19.4
% CHANGE 1985-1986	0.5	3.2	-2.7	8.8
% CHANGE 1983-1986	15.2	48.5	8.7	61.3

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE 3-16

NUMBER OF AND MEDICARE PHYSICIAN EXPENDITURES FOR CHOLECYSTECTOMY, PARTIAL COLECTOMY, HERNIA REPAIR, AND TURP, 1983-1986

NUMBER OF OPERATIONS PER 1000 BENEFICIARIES

HALFYEAR	CHOLECYSTECTOMY	PARTIAL COLECTOMY	HERNIA REPAIR	TURP
JANUARY-JUNE 1983	1.74	1.07	1.23	4.09
JULY-DECEMBER 1983	1.66	0.97	1.21	3.97
JANUARY-JUNE 1984	1.79	1.00	1.29	3.96
JULY-DECEMBER 1984	1.66	0.91	1.25	3.76
JANUARY-JUNE 1985	1.62	0.90	1.35	3.95
JULY-DECEMBER 1985	1.62	1.00	1.32	3.99
JANUARY-JUNE 1986	1.55	0.89	1.37	4.05
JULY-DECEMBER 1986	1.58	0.82	1.29	4.00
% CHANGE 1983-1984	1.5%	-6.4%	4.1%	-4.2%
% CHANGE 1984-1985	-6.1	-0.5	5.1	2.8
% CHANGE 1985-1986	-3.4	-10.0	-0.4	1.4
% CHANGE 1983-1986	-7.9	-16.2	9.0	-0.1

EXPENDITURES PER BENEFICIARY

HALFYEAR	CHOLECYSTECTOMY	PARTIAL COLECTOMY	HERNIA REPAIR	TURP
JANUARY-JUNE 1983	$1.34	$1.17	$0.55	$3.79
JULY-DECEMBER 1983	1.34	1.12	0.58	3.90
JANUARY-JUNE 1984	1.46	1.14	0.62	3.89
JULY-DECEMBER 1984	1.36	1.04	0.60	3.74
JANUARY-JUNE 1985	1.33	1.02	0.66	3.97
JULY-DECEMBER 1985	1.33	1.14	0.65	3.97
JANUARY-JUNE 1986	1.30	1.02	0.68	4.05
JULY-DECEMBER 1986	1.34	0.95	0.64	4.07
% CHANGE 1983-1984	5.2%	-4.8%	8.0%	-0.8%
% CHANGE 1984-1985	-5.7	-0.9	7.4	4.1
% CHANGE 1985-1986	-0.8	-8.8	0.8	2.3
% CHANGE 1983-1986	-1.5	-14.0	16.8	5.6

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

performed by general surgeons, while the last is almost exclusively done by urologists. Cholecystectomy and colectomy rates decline over time, although the change in cholecystectomy volume is probably insignificant. Similar reductions were found for all states, except Washington where rates actually increased for both procedures.

Rates of hernia repair show a slow, but steady, increase over the time period. Most of this growth can be attributed to Washington, where hernia surgery rose 47 percent. Rates increased 6 percent in Alabama, and fell slightly in the remaining two states. The large increase in Washington may be a "catch-up" phenomenon; its effect is to raise the absolute rate of hernia surgery to comparable levels with the other three states.

Finally, TURP surgery rates remain virtually unchanged. Again, Washington is an exception, the number of TURPs per beneficiary increased 8 percent from 1983 to 1986.

3.5.4 Endoscopies

Until now, we have been focussing on therapeutic surgical procedures (with the exception of cardiac catheterization in Table 3-14). Diagnostic surgical procedures are also of interest, however, because they can be performed in physicians' offices and other ambulatory settings and hence utilization rates may be more sensitive to price changes. Table 3-17 presents volume and expenditure data for five endoscopic procedures: colonoscopy, sigmoidoscopy, proctosigmoidoscopy, upper GI endoscopy, and bronchoscopy. The first three endoscopies are similar in nature and have been listed from left to right in order of decreasing complexity; colonoscopy is more invasive than sigmoidoscopy which in turn is more invasive than proctosigmoidoscopy.

Colonoscopy rates have more than doubled over the time period, a trend duplicated in each of the four states. An extraordinarily high jump occurred in the latter half of 1985, presumably in response to the cancer detected by colonoscopy in President Reagan in late 1985. It is noteworthy, however, that rates have continued to climb throughout 1986; there is no indication that they will return to pre-Presidential levels. While volumes more than doubled, spending on colonoscopies increased 145 percent. In 1983, the colonoscopy bill was $3.59 for every beneficiary in the Medicare program; by 1986, the bill averaged $8.79.

Why are expenditures rising so much faster than volumes? The most likely answer, given the fee freeze, is a shift in the mix of procedures. Data in this table include all types of colonoscopies, with and without biopsy, with and without polyp removal, up to versus beyond the splenic flexure, etc. In Section 3.7 below, we will specifically examine changes in procedure codes, and decompose expenditure increases into volume and upcoding components.

TABLE 3-17

NUMBER OF AND MEDICARE PHYSICIAN EXPENDITURES FOR SELECTED ENDOSCOPIC PROCEDURES, 1983-1986

NUMBER OF PROCEDURES PER 1000 BENEFICIARIES

HALFYEAR	COLONOSCOPY	SIGMOIDOSCOPY	PROCTOSIGMOIDOSCOPY	UPPER GI ENDOSCOPY	BRONCHOSCOPY
JANUARY-JUNE 1983	5.70	1.48	9.88	6.62	1.06
JULY-DECEMBER 1983	6.32	1.77	9.57	6.61	1.00
JANUARY-JUNE 1984	7.40	2.27	9.42	7.60	1.14
JULY-DECEMBER 1984	7.71	2.32	8.36	7.25	1.08
JANUARY-JUNE 1985	9.02	3.12	8.61	8.18	1.16
JULY-DECEMBER 1985	12.30	4.89	9.86	8.37	1.13
JANUARY-JUNE 1986	12.81	4.80	7.55	9.34	0.98
JULY-DECEMBER 1986	13.70	5.47	6.73	9.62	0.84
% CHANGE 1983-1984	25.7%	41.2%	-8.6%	12.2%	7.8%
% CHANGE 1984-1985	41.1	74.5	3.9	11.4	3.2
% CHANGE 1985-1986	24.3	28.2	-22.7	14.6	-20.5
% CHANGE 1983-1986	120.5	216.0	-26.6	43.3	-11.7

EXPENDITURES PER BENEFICIARY

HALFYEAR	COLONOSCOPY	SIGMOIDOSCOPY	PROCTOSIGMOIDOSCOPY	UPPER GI ENDOSCOPY	BRONCHOSCOPY
JANUARY-JUNE 1983	$1.67	$0.09	$0.41	$1.68	$0.26
JULY-DECEMBER 1983	1.92	0.12	0.40	1.74	0.27
JANUARY-JUNE 1984	2.29	0.15	0.40	2.00	0.30
JULY-DECEMBER 1984	2.37	0.15	0.35	1.92	0.29
JANUARY-JUNE 1985	2.82	0.21	0.36	2.15	0.31
JULY-DECEMBER 1985	3.94	0.32	0.41	2.21	0.31
JANUARY-JUNE 1986	4.19	0.32	0.32	2.49	0.28
JULY-DECEMBER 1986	4.60	0.39	0.29	2.60	0.25
% CHANGE 1983-1984	29.8%	42.9%	-7.4	14.6%	11.3%
% CHANGE 1984-1985	45.1	76.7	2.7	11.2	5.1
% CHANGE 1985-1986	30.0	34.0	-20.8	16.7	-14.5
% CHANGE 1983-1986	144.8	238.1	-24.7	48.8	0.0

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

Sigmoidoscopy rates have actually tripled over the time period, and spending per beneficiary has more than tripled. Because sigmoidoscopy rates are much lower in absolute terms than those for colonoscopy, however, and because sigmoidoscopy is a much less expensive procedure, the dollar implications of a three-fold growth in volume are considerably smaller. While colonoscopies "cost" the Medicare program $5.20 more per beneficiary in 1986 than in 1983 ($5.20 = $8.79-$3.59), the growth in sigmoidoscopies only added 50 cents.

Utilization rates for proctosigmoidoscopy, the simplest of these endoscopic procedures for the lower GI tract, have been falling over the time period. Since this procedure is the least expensive of the three, the dollar savings have been small in absolute terms, a reduction of 20 cents per beneficiary from 1983 to 1986.

The volume of upper GI endoscopies has also grown rapidly, increasing 43 percent on a per beneficiary basis. Spending has risen at a somewhat faster rate (49% from 1983 to 1986), suggesting some substitution of the more expensive variants of this procedure, e.g., upper GI endoscopy with biopsy. Bronchoscopy rates rose slightly from 1983 to 1985, and then fell in 1986. This pattern was observed in all states except (again) Washington, where bronchoscopy utilization rose sharply in 1986 after three years of little change.

3.5.5 Decomposition of Increased Spending for Surgery

Although we have only examined 17 different groups of surgical procedures, they account for 46 percent of Medicare Part B spending on surgery (based on our four state data). How much of the increase in surgical expenditures per beneficiary can be attributed to these procedures? Are there a few operations that are responsible for most of the increased spending?

Table 3-18 decomposes the $55 increment in surgical expenditures into those portions attributable to various procedures. Just two procedures, lens procedures and colonoscopies, account for one-third (34.8%) of the increase in surgical expenditures, and for over one-seventh (14.4%) of the increase in total physician spending.

As can be seen in Table 3-18, no other procedure comes close to having such an impact on surgical spending, compared with cataract operations and colonoscopies. The procedures with the next largest effect on expenditures are CABG surgery (4.7%), cardiac catheterization (4.0%) and upper GI endoscopy (3.0%). Of the remaining procedures on Table 3-18, only knee replacement accounts for more than one percent of the expenditure increase. We were not able to identify any other individual operation whose expenditure increase accounted for more than a few pennies of the $55 growth in surgical spending

TABLE 3-18

SOURCES OF INCREASE IN MEDICARE SPENDING PER BENEFICIARY FOR SURGERY, 1983-1986

Surgical Procedure	Percent Share	Dollar Share
Lens Procedures	25.3%	$13.89
Colonoscopy	9.5	5.20
CABG Surgery	4.7	2.57
Cardiac Catheterization	4.0	2.18
Upper GI Endoscopy	3.0	1.67
Knee Replacement	1.7	0.96
Hip Replacement	1.0	0.56
Sigmoidoscopy	0.9	0.50
TURP	0.8	0.43
Hip Fracture	0.7	0.37
Hernia Repair	0.3	0.19
Bronchoscopy	0.0	0.00
Carotid Thromboendarterectomy	-0.1	-0.08
Cholecystectomy	-0.1	-0.04
Proctosigmoidoscopy	-0.4	-0.20
Partial Colectomy	-0.6	-0.32
Pacemaker Insertion	-0.7	-0.39
Other Surgery	50.0	27.39
	100.0%	$54.88

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

per beneficiary.* (We will be looking at some more of these procedures when we examine specialty trends in Section 3.6.)

3.6 Time Trends in Spending by Specialty

Up until now, we have been examining changes in expenditures for selected services and procedures, but specialty-specific trends are also of interest. Do all specialties show similar rates of change over time, or are expenditures growing faster for some specialties than for others? If so, can we decompose the increase for those specialties? How much is due to more office visits, for example, and how much to more surgery or more testing?

Table 3-19 compares total spending per beneficiary by specialty for each of the years in our time-series. Although the columns will not sum to total physician spending because low-volume Medicare specialties are excluded (e.g., plastic surgery, allergy, etc.), the specialties listed account for over 95 percent of expenditures on physician services. The fifth column presents the cumulative percent change in spending for each specialty from 1983 to 1986. By comparing the specialty-specific percent changes with that for all physicians on the last line (29.5%), we can see at a glance which specialties have been growing at faster rates than others.

Expenditures have been growing most rapidly for gastroenterologists, where spending per beneficiary has increased a remarkable 73 percent over our short time-series. Medicare outlays have also risen faster for ophthalmologists (57%), dermatologists (53%), cardiologists (49%), psychiatrists (43%), and thoracic surgeons (42%). By contrast, spending for primary care physicians (GPs, FPs, and internists) and for general surgeons has been rising at below average rates. In part, this may reflect a substitution of more specialized physicians for generalists, yet two surgical specialties also show relatively small increases over time: urology and neurosurgery.

Of course, a relatively large increase in spending does not necessarily imply large outlays in absolute terms. Spending for psychiatrists' services has increased 43 percent, for example, but the actual increase is less than $2 per beneficiary and accounts for only 1.4 percent of total expenditure growth from 1983 to 1986 ($1.81/$132.74). By contrast, expenditures for ophthalmologists have risen 57 percent, an increase of almost $23 per beneficiary; this represents over one-sixth (17.3%) of the <u>total</u> growth in Medicare physician spending.

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*Expenditures for surgical services provided by dermatologists, for example, increased about $2 per beneficiary from 1983 to 1986, which represents less than 4 percent of the total increase in surgical spending. However, no one type of skin surgery was responsible for the increase; instead utilization rates rose for a wide variety of procedures, such as skin biopsies, excision of malignant lesions, excision of benign lesions, etc.

TABLE 3-19

TIME TRENDS IN TOTAL MEDICARE ALLOWED CHARGES PER BENEFICIARY BY PHYSICIAN SPECIALTY, 1983-1986

Specialty	1983	1984	1985	1986	Percent Change (1983-1986)
General & Family Practice	$46.96	$48.54	$50.37	$53.00	12.9%
Internal Medicine	78.82	82.07	87.13	92.54	17.4
Dermatology	5.34	6.13	7.45	8.17	53.0
Cardiology	12.34	13.55	15.83	18.42	49.3
Gastroenterology	6.72	7.81	9.35	11.60	72.6
Pulmonary Diseases	4.51	4.75	5.02	5.76	27.7
Nephrology	4.93	5.18	5.98	6.51	32.0
General Surgery	44.97	46.78	47.97	48.99	8.9
Otolaryngology	5.78	6.27	6.91	7.22	24.9
Ophthalmology	39.98	47.95	57.83	62.88	57.3
Orthopedic Surgery	28.38	30.89	32.78	35.38	24.7
OB-GYN	3.58	3.84	4.09	4.18	16.9
Thoracic Surgery	24.18	26.75	29.96	34.31	41.9
Urology	19.23	19.84	20.92	22.57	17.4
Neurosurgery	5.24	5.43	5.65	5.92	13.0
Anesthesiology	21.70	24.54	26.37	27.81	28.2
Radiology	42.59	45.51	50.48	58.02	36.2
Multi-Specialty Group	40.48	42.71	49.15	58.18	43.7
Neurology	5.23	5.64	5.93	6.41	22.5
Psychiatry	4.21	4.40	5.34	6.02	43.0
All Physicians[a]	449.63	483.50	531.83	582.37	29.5

[a]Specialty expenditures by year will not sum to the total for all physicians, as certain (less common) Medicare specialties are not shown here.

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

We know from earlier tables that utilization rates for lens procedures have risen rapidly and that these operations account for a disproportionate share of the total spending increase. Does the increase in cataract surgery fully explain this phenomenal rise in expenditures for ophthalmologists, or do other services play a role as well? Table 3-20 decomposes the $22.90 increase in spending for ophthalmologists into its component parts. Over one-half of the growth is, in fact, from increased spending on cataract surgery (55.6%=60.2-6.8+2.2). Expenditures for other eye surgery also contribute, however, especially trabeculoplasty by laser.

While increased surgical volumes are certainly the single most important factor in explaining escalating expenditures on ophthalmologists, other services are also important; there have been increases in visits, in ophthalmologic ultra-sound procedures (especially A-scans), and in specialized eye services like ophthalmoscopy.

Table 3-21 presents a similar decomposition for services provided by thoracic surgeons. Spending on these physicians increased $10.13 per beneficiary, or 42 percent, from 1983 to 1986. About one-half of that increase was due to increased expenditures for surgery, especially CABG surgery. Except for heart valve replacements which accounted for 4 percent, no other surgical procedure contributed more than a few cents to the spending growth.* It is noteworthy that about 40 percent of the increased spending on thoracic surgeons is attributable to <u>non</u>-surgical services (the remaining 10% is due to increases in assistance at surgery). In particular, there have been increases in visits in both office and hospital settings, in consultations, and in specialized tests. (Unfortunately, test-specific detail was not retained for thoracic surgeons. Thus, we do not know what kinds of tests are being performed more frequently, but they are probably diagnostic cardiac services.)

The increase of $6.08 per beneficiary for cardiologists' services is decomposed in Table 3-22. The growth in spending is due, in almost equal parts, to:

- more visits and consultations, in all settings (28.6%);
- more surgery, especially cardiac catheterization (33.1%); and
- more cardiac tests of virtually every kind, especially echocardiography and ECGs (but with the exception of 24-hour electrocardiographic monitoring and electronic pacemaker analysis (36.3%)).**

*Other procedures examined included lung lobectomy, repair of abdominal aneurysm, carotid thromboendarterectomy, pacemaker repair, and femoral-popliteal bypass grafts.

**We suspect that these latter tests have also increased, but are "hidden" in the "other services" category. It appears that these monitoring services are frequently assigned local codes by the carrier.

TABLE 3-20

DECOMPOSITION OF INCREASED MEDICARE SPENDING PER BENEFICIARY FOR OPHTHALMOLOGISTS' SERVICES, 1983-1986

Medical Care (visits)	**9.8%**
Consultations	**0.9**
Surgery	**75.3**
One-Stage Lens	60.2
Extraction Only	-6.8
IOL Insertion Only	2.2
Trabeculoplasty by Laser	4.7
Other Eye Surgery	15.0
Anesthesia	**1.6**
Assistant Surgery	**-4.8**
Radiology	**4.7**
A-Scans	4.1
Other Ultra-Sound	0.6
Specialized Tests	**7.9**
Ophthalmoscopy	3.6
Other Eye Services	4.3
Other	**4.6**
	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

TABLE 3-21

DECOMPOSITION OF INCREASED MEDICARE SPENDING PER BENEFICIARY FOR THORACIC SURGEONS' SERVICES, 1983-1986

Medical Care	**9.5%**
Office Visits	5.7
Hospital Visits	3.8
Consultations	**3.0**
Surgery	**52.5**
CABG	22.7
Valve Replacement	4.2
Pacemaker Insertion	-2.9
Other Cardiac Surgery	2.8
Other Surgery	25.7
Assistant Surgery	**10.3**
Radiology	**1.4**
Specialized Tests	**16.3**
Other	**7.0**
	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

TABLE 3-22

DECOMPOSITION OF INCREASED MEDICARE SPENDING PER BENEFICIARY FOR CARDIOLOGISTS' SERVICES, 1983-1986

Medical Care	**22.2%**
Office Visits	12.3
Hospital Visits	8.2
Other Visits	1.7
Consultations	**6.4**
Surgery	**33.1**
Left Heart Catheterization	25.2
Swan Ganz Catheterization	3.5
Pacemaker Insertion	1.8
Other Surgery	2.6
Specialized Tests	**36.3**
ECGs	7.6
Stress Tests	4.4
24 Hr. Monitoring	-2.3
Pacemaker Analysis	-1.3
Echocardiography	10.0
Other Tests	17.9
Radiology and Other	**2.0**
	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

Table 3-23 presents a similar decomposition for the $4.88 increase in expenditures per beneficiary for the services of gastroenterologists (a remarkable 73% gain over 1983 levels). Although the volume of visits and consultations have grown, almost all of the increase (82.4%) in spending has come from surgical procedures, especially colonoscopy and upper GI endoscopy. About one-half of the total increase in gastroenterologists' expenditures can be attributed to colonoscopy alone (48.8%).

Finally, we show the sources of increase in spending on radiologists in Table 3-24. Since 95 percent of expenditures for radiologists are for radiology services, we show only these services in the table. Radiology services include not only diagnostic x-rays, but ultra-sound, nuclear medicine, and radiation therapy. Spending on radiology services has increased 36 percent from 1983 to 1986, or a net addition of $14.66 per beneficiary.*

CAT scans account for over one-third of the increase (34.8%=12.5% for CAT scans of the head + 22.3% for other CAT scans). An additional one-third can be attributed to the increased volume of diagnostic x-rays, which include bread and butter procedures like chest x-rays. At least some of this increase is due to the PPS incentive to shift routine diagnostic testing outside the hospital.

Two cancer-related procedures, one preventive (mammography), the other therapeutic (radiation therapy), each account for over 10 percent. The contributions of the remaining services to the growth in radiology expenditures are relatively small. The apparent small increase in magnetic resonance imaging (MRI) is deceiving, however, since no Medicare bills were even submitted for this procedures until over half-way through the time-series. Expenditures were virtually zero in 1985, but had already exceeded a dollar per beneficiary by 1986.

3.7 Shifts in Distribution of Procedure Codes, or "Upcoding"

Earlier we saw that expenditures for certain services had been increasing faster than was the volume of those same services. This was observed not only for office and hospital visits, but also for some surgical procedures, like colonoscopy. As fees per service were frozen for most of this time period, one possible explanation is upcoding; physicians may be billing for more expensive visit and procedure codes than previously.

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*This is an underestimate of the total increase in radiology outlays per beneficiary, as x-rays are provided by physicians in other specialties as well.

TABLE 3-23

DECOMPOSITION OF INCREASED MEDICARE SPENDING PER BENEFICIARY FOR GASTROENTEROLOGISTS' SERVICES, 1983-1986

Medical Care	**9.0%**
Office Visits	7.8
Hospital Visits	1.2
Consultations	**6.1**
Surgery	**82.4**
Colonoscopy	48.8
Upper GI Endoscopy	24.4
Sigmoidoscopy	3.3
ERCP	3.5
Other Surgery	2.4
All Other Services	**2.5**
	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

TABLE 3-24

DECOMPOSITION OF INCREASED MEDICARE SPENDING PER BENEFICIARY FOR RADIOLOGISTS' SERVICES, 1983-1986[a]

Head CAT Scans	=	12.5%
Other CAT Scans	=	22.3
Mammography	=	10.6
Nuclear Medicine	=	4.6
Diagnostic Ultra Sound	=	3.2
Magnetic Resonance Imaging	=	4.6
Radiation Therapy	=	11.9
Chest X-Rays	=	6.6
All Other Diagnostic X-Rays	=	23.7
		100.0%

[a]Based on spending for radiology services only (over 95% of all expenditures to radiologists).

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

3.7.1 Office and Hospital Visits

The top half of Table 3-25 presents the frequency distribution of total office visits across their eleven HCPCS codes for each of the years in our time-series. There is no question but that there has been a considerable shift in mix of codes. The two simplest follow-up office visit codes (minimal and brief) have declined as a percent of total visits, and the four more complex ones have all increased. While the relative frequency of brief visits fell from 37 percent to 19 percent, for example, limited visits rose from 29 to 36 percent, and intermediate visits from 20 to 29 percent of all visits. Initial (new patient) visits declined slightly after 1983, presumably as follow-up visits increased in relative frequency as a result of PPS. (As patients are discharged quicker, more return visits in the physician's office become necessary.)

Similar patterns were observed for all states. Connecticut demonstrated considerably larger shifts, however, than did the other three states. Upon Discussion with the carrier revealed (contrary to our initial understanding) that HCPCS billing did not formally begin until January 1, 1984. Apparently, our 1983 Connecticut claims had been converted to HCPCS by the original carrier. Since Connecticut switched Part B carriers in late 1985, we have not been able to learn more about this process, especially how similar the old procedure coding terminology may have been to HCPCS (it may, in fact, have been a version of CPT-4). It should be noted, however, that Connecticut continues to display disproportionately larger code shifts, compared with the other three states throughout the time period.

Similar shifts are observed for hospital visit codes (see the bottom half of Table 3-25). The relative frequency of the simplest follow-up hospital visit (brief) was halved from 1983 to 1986, while that for intermediate follow-up visits increased from 22 to 30 percent and comprehensive follow-ups doubled. The slight increase in initial hospital visits as a percent of all visits is undoubtedly a PPS effect; as lengths of stay shorten, the relative number of inpatient follow-ups also fall.*

It is important to emphasize that, while evidence of significant upcoding over time is indisputable, this does not necessarily imply fraudulent billing on the part of physicians. The various office and hospital visit codes are not defined using objective criteria, and physicians may be legitimately confused over the precise meaning of, say, limited versus intermediate visits. The introduction of PPS, furthermore, has undoubtedly altered the content and intensity of both office and hospital visits. With

*As part of another study under this grant, we are examining PPS impacts on physician services at the DRG-specific admission level.

TABLE 3-25

SHIFTS IN DISTRIBUTION OF MEDICARE OFFICE AND HOSPITAL VISIT CODES, 1983-1986

	1983		1984		1985		1986	
Office Visits								
New Patient								
Brief	0.8%		0.6%		0.6%		0.5%	
Limited	2.3		1.9		1.8		1.6	
Intermediate	2.1	6.7%	1.4	5.7%	1.7	6.0%	1.9	6.1%
Extended	0.4		0.5		0.5		0.6	
Comprehensive	1.1		1.3		1.4		1.5	
Established Patient								
Minimal	2.1		2.0		1.8		1.7	
Brief	37.2		31.6		24.7		18.9	
Limited	29.4		31.4		33.6		36.1	
Intermediate	19.6		22.7		25.9		28.8	
Extended	3.2		3.9		4.9		5.2	
Comprehensive	2.0		2.7		3.2		3.1	
	100.0%		100.0%		100.0%		100.0%	
Hospital Visits								
Initial Care								
Brief	1.1%		0.9%		0.7%		0.7%	
Intermediate	3.3	9.5%	3.4	10.2%	3.2	10.7%	2.7	10.7%
Comprehensive	5.1		5.9		6.8		7.3	
Subsequent Care								
Brief	30.1		26.2		19.9		15.3	
Limited	32.2		30.9		30.8		32.7	
Intermediate	22.4		25.3		28.9		30.1	
Extended	3.7		4.3		5.7		6.2	
Comprehensive	1.5		2.1		2.7		3.1	
Discharge Day Management	0.6		1.0		1.4		2.0	
	100.0%		100.0%		100.0%		100.0%	

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

declining admission rates and inpatient stays, hospital patients should be sicker and the average hospital visit more complex. Similarly, with earlier discharges, office patients should be sicker on average and require longer visits.

Nevertheless, regardless of the reason for upcoding, it has had significant dollar implications for the Medicare program and beneficiaries. We calculated expected expenditures for office and hospital visits for 1986, that is, what Medicare would have paid for visits if physicians had billed with the same relative frequency as in 1983. The following formula was used:

$$\hat{EXP}_{1986} = \sum_i w_i * P_{1986}$$

where

$$W_i = (NOS_{i1983} / \sum_i NOS_{i1983}) * NOS_{1986}$$

and where $\hat{EXP}$= expected total Medicare expenditure for visits; W_i = 1986 volumes reweighted to 1983 frequencies; NOS_i=the number of visits in the i-th procedure code category; P_i=the average allowed charge for the i-th category; and the subscripts 1983 and 1986 refer to the calendar years. When subtracted from actual outlays in 1986, we obtain a dollar estimate for upcoding. (Since 1986 data are used for number of visits and for per visit reimbursement, we have held volume and price constant.) Table 3-26 compares expected and actual expenditures for office and hospital visits.

If physicians in our four states had billed office and hospital visit codes with the same relative frequency in 1986 as they did in 1983, the Medicare program and its beneficiaries would have "saved" over $20 million ($11.6 million on office visits and $8.8 million on hospital visits). This helps explain why visit expenditures have been increasing so much more quickly than the number of visits themselves. Recall from Tables 3-12 and 3-13 that office visit expenditures per beneficiary rose 36 percent from 1983 to 1986, while volume increased "only" 21 percent. Based on our calculation of expected versus actual outlays on office visits, over 7 percent of 1986 expenditures can be attributed to "upcoding" ($11.6 million/$163.8 million). Similarly, expenditures on hospital visits failed to fall as rapidly as the actual number of hospital visits, because of the offsetting effect of "upcoding"; spending was over 6 percent higher than it would have been in the absence of coding changes.

It is clear from Table 3-26 that Connecticut accounts for a disproportionate share of the difference between actual and expected expenditures, particularly for office visits. Since the 1983 distribution of visit codes in Connecticut was based on converted codes (whose similarity to HCPCS is unknown), it is possible that we have greatly overstated the extent of upcoding in this state. We re-calculated expected expenditures in all states, using the same formula but substituting the 1984 distribution of visit codes. The results were basically the same; Connecticut still accounts for the bulk of the actual-expected differential.

TABLE 3-26

EXPECTED AND ACTUAL MEDICARE PART B EXPENDITURES FOR OFFICE AND HOSPITAL VISITS, 1986

	Expenditures (in millions)		
	Office Visits	Hospital Visits	Total
Alabama			
Actual Expenditures in 1986	$ 39.3	$ 44.5	$ 83.8
Expected Expenditures in 1986[a]	37.7	43.3	81.0
Difference (actual-expected)	1.6	1.2	2.8
Percent of Actual Expenditures Due to Code Shift	4.1%	2.7%	3.3%
Connecticut			
Actual Expenditures in 1986	$ 40.3	$ 27.6	$ 67.9
Expected Expenditures in 1986[a]	33.1	24.1	57.2
Difference (actual-expected)	7.2	3.5	10.7
Percent of Actual Expenditures Due to Code Shift	17.9%	12.7%	15.8%
Washington			
Actual Expenditures in 1986	$ 44.4	$ 26.9	$ 71.3
Expected Expenditures in 1986[a]	43.0	25.5	68.5
Difference (actual-expected)	1.4	1.4	2.8
Percent of Actual Expenditures Due to Code Shift	3.2%	5.2%	3.9%
Wisconsin			
Actual Expenditures in 1986	$ 39.8	$ 35.6	$ 75.4
Expected Expenditures in 1986[a]	38.4	32.9	71.3
Difference (actual-expected)	1.4	2.7	4.1
Percent of Actual Expenditures Due to Code Shift	3.5%	7.6%	5.8%
All States			
Actual Expenditures in 1986	$163.8	$134.6	$298.4
Expected Expenditures in 1986[a]	152.2	125.8	278.0
Difference (actual-expected)	11.6	8.8	20.4
Percent of Actual Expenditures Due to Code Shift	7.1%	6.5%	6.8%

[a]Expected expenditures, given 1986 allowed charges per visit, 1986 visit volume, and 1983 distribution of visit codes.

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

3.7.2 Colonoscopies

Although the problem of upcoding is most commonly associated with visits, it can also occur with other types of physician services, like surgery. Fiberoptic colonoscopy, a diagnostic surgical procedure with 13 different codes, is a good example. HCPCS coding permits physicians to bill different codes, depending on whether other services are performed at the same time; biopsies may be obtained, for example, bleeding may be controlled, or polyps may be removed. The coding system also allows physicians to distinguish between those colonoscopies where the fiberoptiscope is inserted up to the first major bend in the large intestine (the splenic flexure) and those which extend beyond the splenic flexure.

Table 3-27 presents the frequency distribution of all colonoscopies by year across four groups of procedure codes: diagnostic colonoscopy up to splenic flexure, all other colonoscopies up to splenic flexure (including biopsies, polyp removal, etc.), diagnostic colonoscopies beyond the splenic flexure, and all other. While the relative frequency of simple diagnostic colonoscopies has remained unchanged over the four year time period, there has been a major shift toward colonoscopies beyond the splenic flexure that involve other procedures. In 1983, almost one-fourth (24.1%) of all colonoscopies went beyond the splenic flexure and included additional services like biopsies; by 1986, these accounted for almost one-third of all colonoscopies.

What exactly were physicians doing during these colonoscopies? Unfortunately, we did not retain detailed colonoscopy information for all specialties performing this procedure, but we do have a finer break-down for gastroenterologists. While a number of other specialists provide colonoscopies, especially internists, gastroenterologists account for about one-third of the total. Table 3-28 presents a frequency distribution of colonoscopies for gastroenterologists only. For procedures performed beyond the splenic flexure, there has been a relative increase in those involving both biopsies and polyp removals.

We used the same methodology used earlier for office and hospital visits to calculate expected 1986 expenditures on colonoscopies had physicians billed the same mix of procedure codes in 1986 as they did in 1983. Upcoding accounted for only a small fraction of the increase in per beneficiary expenditures for colonoscopy (1.9%). Minor price increases were responsible for an additional 5 percent.* (Prices increased from 1983 to 1986 as a result of the May 1986 update for participating physicians, and because of a shift in provider mix to more expensive specialties, like gastroenterology.)

*Expected expenditures with no price change were calculated by substituting 1983 prices for the 1986 prices in the formula above.

TABLE 3-27

SHIFTS IN DISTRIBUTION OF COLONOSCOPY CODES OVER TIME - ALL PHYSICIANS, 1983-1986

	1983	1984	1985	1986
Diagnostic colonoscopy to splenic flexure (45360)	33.3%	33.0%	33.3%	33.3%
Other colonoscopies to splenic flexure (45365-45372)	9.5	9.2	7.5	6.9
Diagnostic colonoscopy beyond splenic flexure (45378)	33.1	30.1	28.9	28.0
Other colonoscopies beyond splenic flexure (45379-45385)	24.1	27.7	30.3	31.8
	100.0%	100.0%	100.0%	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington, and Wisconsin

TABLE 3-28

SHIFTS IN DISTRIBUTION OF COLONOSCOPY CODES - GASTROENTEROLOGISTS, 1983-1986

	1983	1984	1985	1986
Up to splenic flexure:				
Diagnostic colonoscopy (45360)	27.1%	25.2%	21.1%	18.3%
Colonoscopy with biopsy (45365)	3.3	4.8	3.9	3.5
Colonoscopy to remove polyps (45370)	4.0	3.4	2.1	2.1
All other colonoscopies (45367-45369, 45371)	0.0	0.1	0.2	0.3
Beyond splenic flexure:				
Diagnostic colonoscopy (45378)	38.8	33.7	34.2	33.3
Colonoscopy with biopsy (45380)	8.0	11.7	12.3	13.5
Colonoscopy to remove polyps (45385)	18.6	20.7	25.3	27.6
All other colonoscopies (45379-45382, 45383, 45386)	0.2	0.3	0.8	1.4
	100.0%	100.0%	100.0%	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington, and Wisconsin

Virtually all of the increased spending on colonoscopies is due to volume (93.1%). The absolute number of these procedures grew 133 percent from 1983 to 1986; even after adjusting for the growth in Medicare enrollees, colonoscopy volume doubled (recall Table 3-17). Although Table 3-27 shows a definite trend toward more complicated colonoscopies, the financial implications of this shift are overwhelmed by the increased number of colonoscopies at every level of complexity.

3.8 Time Trends in Specialty Shares

Even if no upcoding occurred during the physician fee freeze, it is still possible for expenditures to increase for individual services. This may happen if the Medicare carrier reimburses specialists more for the same procedure, and if the specialty mix of physicians is changing over time.

Table 3-29 compares physician specialty shares over time, where shares are defined as the percent of total Medicare physician expenditures billed by each specialty. As expected, general and family practitioners are providing an increasingly smaller share of Medicare services. More surprising is the fact that internists also are providing proportionately less over time. Although still the specialty responsible for the largest single share of the Medicare dollar, internal medicine's share has fallen slowly but steadily, 1.6 percentage points over the four year study period. That has been almost totally made up by medical specialists whose collective share has increased from 7.5 to 8.7 percent (summing the percentages for dermatologists, cardiologists, gastroenterologists, pulmonary disease specialists, and nephrologists).

The carriers in three of our four states, like most Medicare carriers, appear to recognize specialty differentials in their fee screens, especially for the various kinds of visits.* Consider a limited visit with an established patient, for example, one of the most common types of office visits. The average allowed charge for this visit when provided by an internist is 11-24 percent higher than the same visit from a GP, and 17-39 percent higher when provided by a cardiologist. Thus, visit expenditures will increase in part as cardiologists provide more visits relative to internists and GPs.

*There appeared to be no real differences in average reimbursement for any of the office visit codes in Washington.

TABLE 3-29

TIME TRENDS IN MEDICARE PHYSICIAN SPECIALTY SHARES, 1983-1986 (percent of total allowed charges)

Specialty	1983	1984	1985	1986
General & Family Practice	10.4%	10.0%	9.5%	9.1%
Internal Medicine	17.5	17.0	16.4	15.9
Dermatology	1.2	1.3	1.4	1.4
Cardiology	2.7	2.8	3.0	3.2
Gastroenterology	1.5	1.6	1.8	2.0
Pulmonary Diseases	1.0	1.0	0.9	1.0
Nephrology	1.1	1.1	1.1	1.1
General Surgery	10.0	9.7	9.0	8.4
Otolaryngology	1.3	1.3	1.3	1.2
Ophthalmology	8.9	9.9	10.9	10.8
Orthopedic Surgery	6.3	6.4	6.2	6.1
OB-GYN	0.8	0.8	0.8	0.7
Thoracic Surgery	5.4	5.5	5.6	5.9
Urology	4.3	4.1	3.9	3.9
Neurosurgery	1.2	1.1	1.1	1.0
Anesthesiology	4.8	5.1	5.0	4.8
Radiology	9.5	9.4	9.5	10.0
Multi-Specialty Group	9.0	8.8	9.2	10.0
Neurology	1.2	1.2	1.1	1.1
Psychiatry	0.9	0.9	1.0	1.0
Other Specialties	1.0	0.6	1.3	1.4
	100.0%	100.0%	100.0%	100.0%

Source: Medicare Part B claims for Alabama, Connecticut, Washington and Wisconsin.

4.0 MULTIVARIATE ANALYSIS

4.1 Introduction and Overview

The preceding analysis has been tabular in nature showing trends in Medicare physician spending by type of service and specialty. Although useful, it suffers from two limitations. First, no statistical tests were performed to test whether post-freeze growth rates were more or less than previous trends. Second, none of the confounding effects of other variables were held constant. This chapter addresses these limitations by presenting multivariate statistics on both the freeze effects and the relative importance of confounding variables, of which PPS is the most important.

In the next section we present a model of physician behavior that explains their involvement in the Medicare program more generally. We then apply the model to the fee freeze to derive a few testable hypotheses of fee freeze effects, including a consideration of the decision to accept all patients on assignment.

Next, we consider the appropriate analytic design to test for freeze effects. A lack of a long time series and the data limitations preclude more rigorous approaches, forcing us to rely on a more general quasi-experimental design using interrupted time series regression. This is followed by a discussion of regression methods and a set of caveats in interpreting the results.

Section 4.4 provides a set of econometric results, first, for total charges per beneficiary, followed by a similar set for the quantity of services and, finally, upcoding.

4.2 Theoretical Framework

4.2.1 A Model of Physician Behavior Under Medicare

The theoretical model used in this study to predict the effects of a fee freeze that acts through the mechanism of price or allowed charges has been used previously by the investigators.* In this model, the physician is regarded as facing demand schedules in two separate markets, a fee setting market and a price taking market. In the fee setting market, the physician establishes the price of his services and the patient either pays out of pocket and/or through a third party. Note that the fee setting market, under ordinary circumstances, can include both Medicare and non-Medicare patients.

*See, for example, Cromwell and Mitchell (1982) and Mitchell and Cromwell, (1983).

In the price taking market, on the other hand, the physician accepts the fee schedule of the third party payor as payment in full. In this case, the third party payor is Medicare and the payment level corresponds, roughly speaking, to Medicare allowed charges. The physician also bills the patient for the 20 percent of the prevailing charge not paid by Medicare.

The physician's problem is to establish a price level in the fee setting or non-assigned market and to pick a quantity of services to be provided in the price taking or assigned market. The problem is the same as that faced by a profit maximizing price discriminator, except that only a single price is being set by the physician; in the assigned market quantity rather than price is chosen.

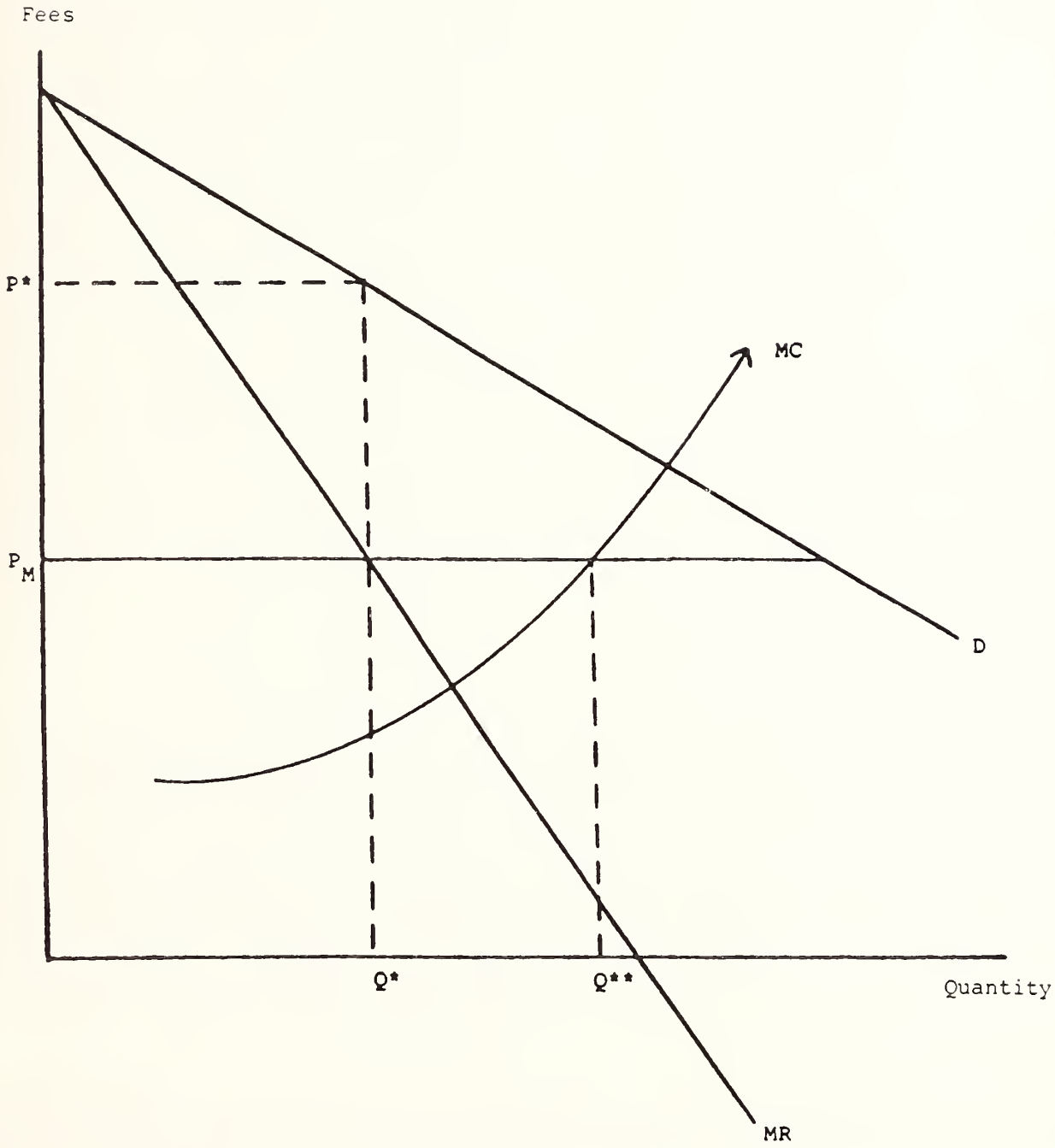
The diagrammatic solution to this problem is indicated in Figure 4-1. Here, the two markets have been superimposed over one another so that the solution can be indicated on a single graph. The fee setting market presents the physician with a downward sloping demand (line D) and marginal revenue schedule (line MR), while the Medicare assigned market presents the physician with a constant or horizontal marginal revenue schedule equal to P_m, the allowed charge. Assuming that the physician would supply both markets, the optimal price in the fee setting market should imply equal marginal revenues in the two markets. Thus, given a constant marginal revenue of P_m in the assigned market, the physician will treat non-assigned patients until price falls to P* where private marginal revenue equals P_m. Moreover, given the physician's hypothesized marginal cost curve, MC, the optimal level of assigned Medicare services is indicated as Q** - Q*. Supplying Q** services in toto equates marginal revenue in both markets with marginal costs.

4.2.2 Predicted Effects of a Fee Freeze

The effects of a Medicare fee freeze on physician behavior are straightforward in lieu of any gaming of the system or backward-bending supply. A fee freeze in the face of inflation in both practice costs and non-Medicare payment rates has the effect of shifting physician supply (or marginal costs) upwards and non-assigned non-Medicare demand outwards. For a constant, or frozen, allowed charge, P_m, this would unequivocally reduce both total services provided across all markets (i.e., Q** would shift to the left as MC rises) and especially in the Medicare-assigned market. With frozen fees, declining volumes should definitely reduce total Medicare expenditures as well.

Several modification to the theory are considered next.

FIGURE 4-1: A MODEL OF PHYSICIAN BEHAVIOR UNDER MEDICARE



4.2.3 Impact of Participation

As a part of the structure of incentives offered to physicians at the time the freeze was implemented, a number of physicians signed an agreement stipulating that they would accept all of their Medicare patients on assignment (about 30% agreed to). The principal advantages to signing the agreement were: (a) the promise of post-freeze Medicare updates; (b) inclusion in a Medicare directory of participating physicians that never balance bill; and (c) a promise that actual physician charges would not be frozen, leading to higher post-freeze allowed charges. The obvious disadvantage to signing was giving up any balance billing, the economic value of which is represented by the rectangle, $(P^*-P_m).Q^*$, in Figure 4-1, assuming all non-assigned cases were also Medicare.*

For physicians always or never taking any patients on assignment, the participation option should have had no additional behavioral effects over-and-above the freeze. However, for physicians with a mix of assigned and non-assigned patients, an all-or-nothing decision** had to be made. In weighing the options, they had to evaluate the expected loss of balance billing if they signed the agreement against the expected loss of patients and future updates in Medicare payments.

The net effect of these decisions appears to have been a sharp rise in claims and dollars taken on assignment (Burney and Paradise, 1987). This should not produce any material change in total Medicare volumes, however, unless physicians choose to "game" the system more through upcoding or shifting demand to make up for lost income.

4.2.4 Perverse Responses to the Fee Freeze

Unfortunately, the simple theoretical results obtained above are not robust to dropping some of the key assumptions underlying the model. For example, it could be plausibly argued that over some range of fees and income, physician supply curves slope backward. If this is the case, then the effects of a fee freeze on Medicare service provision become ambiguous. Given a backward bending supply curve, the physician's overall quantity of services increases in response to a Medicare fee freeze rather than falling. This is because they desire to maintain a fixed "target" real income and are willing to supply more services at lower payment rates to maintain it. Whether the

*Of course, very few physicians see only Medicare patients so that the rectangle substantially overstates the potential loss of foregoing balance billing.

**This all-or-nothing decision was quite mild because, unlike Medicaid patients, non-assigned Medicare patients still can collect 80 percent of the allowed fee from Medicare.

provision of Medicare services increases as well depends upon whether the increase in overall service provision dominates the expected shift away from Medicare patients and towards non-Medicare patients because of the freeze. In technical economic terms, frozen Medicare fees may have a perverse "income" effect on physician supply resulting in more services *in toto* which could offset the clear "price" incentive to substitute non-Medicare for Medicare patients.

Another context in which a freeze could lead to increased quantity provision is in demand constrained markets. That is, assume that physicians are constrained at the margin in the number of services they can supply to Medicare beneficiaries. Then even if the physician's marginal cost curve shifts backwards in the event of a freeze, quantities may not fall since supply is not the determining factor of equilibrium quantity. Instead, if Medicare patients are sensitive to price at the margin, an increase in quantities may result since demand rises due to the reduction in real copays and deductibles. Of course, in markets where demand is not sensitive to price at the margin (i.e., markets where the copay is waived by the physician), no effect on quantity would be predicted. Of course, in such markets, the shape of the physician's marginal cost curve is not relevant.

Finally, note that the theoretical predictions made in Section 4.2.2 are valid only under standard neoclassical economic principles which neglect the possibility of behaviors such as demand inducement, irrational anger, and "gaming" the system. Physicians might choose to respond to the freeze by increasing the alleged complexity of their coding for an unchanged mix of services, i.e., so-called upcoding. This type of behavior implies a utility maximizing model in which physicians prefer not to "miscode" their bills to Medicare, but they will do so if their income level is reduced.* A model of demand inducement would work under the same general principles with both resulting in an outward shift in demand. In the presence of upcoding and demand inducement, the hypothesized negative effects of a Medicare fee freeze on Medicare expenditures are diminished and may even result in physicians doing whatever is necessary to maintain their incomes in whatever manner they have become accustomed to. On the another hand, it is still difficult to imagine that inducement or gaming could significantly increase volumes and expenditures, or physicians would already have done so.

The possibility of strictly irrational behavior, while naturally difficult to model *ex ante*, must also be considered. For this, let us turn to discussion of dynamic responses to the freeze.

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*An extensive literature exists that treats upcoding and inducement as a negative argument in the physician's utility function, e.g., Evans, 1974; Reinhardt, 1978; Roehrig, 1980.

4.2.5 Dynamic Responses to the Fee Freeze

The possibility of gaming the system in response to the freeze suggests a short-run, perverse behavior that highlights the time-phasing of physician responses. Static comparisons have been hypothesized between two points in time, one prior to the freeze versus another after all responses have been made. Because of the relatively short time frame of our analysis, it seems especially important to consider how rapidly physicians (or patients) might respond.

Under a standard model with low inflation, as existed in the summer of 1984, one would predict a very slow cut-back in Medicare volume when fees were frozen, ceteris paribus. Then, as the gap between practice costs and fees began to widen, physicians should have responded more aggressively to the freeze. Thus, quarterly responses to the freeze should be minimal at first, then grow as real fees fall.

A variation on this standard model would have a larger negative response in the beginning as physicians anticipate future real fee declines and reduce Medicare supply. Yet, over time their ability and predilection to game the system through upcoding and demand inducement may increase, causing volumes and expenditures to rise more rapidly than before the freeze as they recover lost revenues.

Summarizing, two dynamic response functions can be hypothesized based on three separate theories. The first model of the perfectly rational physician is consistent only with a slow, but constantly growing, response to the freeze while two non-standard theories could explain a very large initial reduction followed by more rapid volume and expenditure growth in a "catch-up" phase. Because the policy implications of different models may also vary, it is important to capture the time phasing of physician responses to the extent possible. Note that if large reductions in Medicare volumes and expenditures are observed in the first quarter or two of the freeze, a standard economic model of a perfectly rational, non-gaming physician can be rejected, but we still could not distinguish between the other two non-standard models.

4.3 Quasi-experimental Versus Structural Modelling

The key point made in the foregoing discussion is that the physician's and patients' responses to a fee freeze is conceivably consistent with a wide range of behaviors. While a simple neoclassical methodology predicts declining expenditures and service provision, the opposite result can be achieved under backward-bending supply or perhaps demand inducment as well. Moreover, the effects of a fee freeze on expenditures can easily be circumvented if physicians engage in upcoding, say, by reporting a more complex mix of service provision in their office. We have also argued for the necessity of evaluating the time path of responses.

In a fully elaborate structural approach to analyzing the freeze, each of these possibilities could be tested structurally. In the language of econometrics, the structural approach requires the estimation of structural equations involving several endogenous variables and a well defined path of causality, with the effects of a policy measured by its associated effect on a key exogenous variable (e.g., price) in the model's structure. Thus, for example, the possibility of backward-bending supply could be tested by estimating a physician equation which included physician income as a covariate.

Unfortunately, structural modelling places a high emphasis on correct modelling and data availability. Structural modelling of physician behavior requires a wealth of data on the physician's practice costs and his/her value of time, as well as demand curves in both the Medicare and non-Medicare markets. It proved infeasible to construct a data base which included these varied categories of data so that pursuing the structural approach could not be done in a fully satisfactory way.

As data limitations precluded using a fully articulated structural approach in the present study, we were limited instead to a compromise methodology which lay somewhere between the fully elaborated structural approach and a simple reduced form. That is, our method imposed the structural constraint of forcing the effects of the fee freeze to work through an intervening variable, the real Medicare allowed charge (RMAC). Explicit controls for the freeze were not included in the regression. Instead a measure of RMAC was included in the regression and the effects of the freeze were assessed by gauging the effect of the freeze on RMAC. A constraint of this sort is similar, in spirit, to a structural approach to the problem, in that theoretical priors are used to shape the econometric specification and the path of causality. Our approach is not fully structural, however, because we did not model all aspects of supply and demand due to the aforementioned data problems.

Still, the logic behind our approach is simple and easy to understand. Since the immediate effect of the fee freeze was to reduce the real deflated allowed Medicare charge, the effect of the fee freeze can presumably be assessed in two steps: (1) by estimating the statistical relationship between RMAC and Part B quantities in a regression approach, and (2) by subsequently estimating the effect of the freeze on RMAC, as discussed above. If, for example, we were to find that the real Medicare allowed charge bears a positive relationship with Part B quantities, then since the fee freeze reduced the real Medicare allowed charge, we would conclude that the fee freeze reduced Part B quantities as well. On the other hand, if we found that RMAC related negatively to Part B quantities in our regression (due, for example, to the backward bending supply theory discussed earlier) then we would conclude that the freeze's reduction in RMAC resulted in higher Part B quantities.

The clear disadvantage of our approach is that the effect of the fee freeze may be understated if, for example, the freeze triggers some sort of physician response unrelated to its effects on the Medicare price. Thus, for example, the freeze may generate expectations in physician's minds about the future path of Medicare policy and thereby physician behavior in the Part B market. Obviously, such effects would not be picked up by assessing the freeze's effects on the real allowed Medicare fee per se. More is said about these possible biases below.

The potential advantage of our method is that it enables us, in theory, to separate the effects of the fee freeze from the time-series-related events, and in particular PPS. This is accomplished by utilizing some of the cross-sectional variation in Medicare's allowed price in the estimation of its coefficient and, by implication, the estimation of the effect of the freeze. Since, as discussed below, the ability of our method to disentangle the effects of the freeze from other time-related events is crucial, this method is the preferred one.

4.4 Validity, Generalizability, and Causality

Having resolved the question of which methodology to pursue, this leaves an equally important issue unresolved. Namely, what sort of interpretation should be assigned to the results obtained from the quasi-experimental regression methodology? This broad question, in turn, can itself be divided into a number of smaller questions including: How reliable are the results we obtain? Are they subject to bias? To what extent can a causal relationship be inferred between the implementation of the freeze and the trend in Part B expenditures over this period? Can we understand how the freeze affected Part B expenditures over this period? How certain are we that our results from four states generalize to all areas of the country? And, finally, can we infer the likely affects of implementing another fee freeze?

Consider, first, the issue of reliability. In principle, this is an issue concerning the mean squared error of the estimates. That is, the reliability of the estimates can be measured both in terms of their variance as well as their bias.

As far as bias is concerned, there are a couple of problems to be aware of. First, we have not inserted an explicit control for underlying trends in technology growth which may be positively affecting the time trend in Part B expenditures. While our results suggest that trends in technology are most likely to load onto the regression coefficient of per capita income, there is some chance that the coefficient of allowed Medicare price is affected as well. For example, assuming the trend in technology growth and diffusion is negatively correlated with Medicare's real allowed fee, then the coefficient on the allowed price variable should be biased in the negative direction, away

from a finding that the freeze reduced quantity. This enables the trend in Medicare price to fit technology's positive contribution to Part B expenditures.

A second potential source of left out variable bias arises from our failure to incorporate variables affecting the physician's practice, including important changes in non-Medicare demand. If non-Medicare third party utilization review or payment rates became more stringent over the freeze period, then physicians may have substituted service provision to Medicare beneficiaries in spite of the freeze. In this case, the measured success of the freeze in holding down Medicare expenditures would be biased towards a null finding.

The introduction of PPS, of course, was the major confounding event which should have had some effects (presumably positive) on physician demand. If our controls for PPS include some error, it is possible that some of the PPS effects could be incorporated into the measured freeze effects giving us yet another source of bias. To address the PPS "problem", we have employed a measure of its effect using inpatient days. In addition, we have again tested the robustness of our results by considering various lag structures for the PPS control. These are discussed below in the section on econometrics.

Of course, the major issue affecting the variance of our estimates is the multicollinearity of the variables. Even if our various controls for PPS and other time varying covariates are accurate and complete, the right-hand side variables in the analysis could be highly correlated. The problem could manifest itself in large standard errors or large, opposite and implausible signs for the collinear variables. This is perhaps the most difficult statistical issue to deal with. The strategy we have employed, which is discussed in additional detail below, was to exploit wherever possible cross-sectional variation to gain leverage on the problem of intertemporal collinearity.

If we assume that bias is not a significant problem, how is the causal impact of the freeze to be assessed? Strictly speaking, the absence of bias in the variables used to assess the freeze implies that these variables capture the "causal" impact of the freeze upon expenditures. However, the exact path of the effect and the associated type of causality are still obscured. In particular, it is useful to distinguish between two general scenarios.

Consider, first, the possibility that the estimated coefficient on the allowed price variable is positive. Assuming the freeze produced a slow cumulative reduction in the real allowed Medicare price, a positive coefficient would imply that the freeze also produced a slow cumulative reduction in Part B expenditures. As noted above in Section 4.2.5, a slow cumulative reduction in Part B physician volumes and expenditures is consistent with a price-induced substitution away from Medicare to non-Medicare patients.

On the other hand, if the estimated coefficient on the allowed price variable is negative, then conversely, this would imply that the freeze's reduction in real allowed charges contributed positively to Part B expenditures. Most certainly, a negative coefficient on real allowed price would, in turn, suggest that there are either (1) "income related" considerations in the physician's supply decision or (2) that physicians constrained by price sensitive demand at the margin. Any movements along the physician's backward bending supply curve will also depend in part on his ability to induce demand as well; that is, the physician's desire to increase supply in response to the freeze may depend on his ability to convince his patients that more care is needed, particularly in geographic regions where the physician's desired supply exceeds Medicare demand. In short, the stronger the perverse set of (increase in) quantity responses, the greater the likelihood that downward sloping supply is being augmented by some form of demand inducement.

It should be noted that any of the alternative scenarios may imply non-standard behavior, including backward bending supply, demand inducement, or deliberate upcoding of reported services. The acceptance of one theory does not, for the most part, rule out anything other than neoclassical behavior.

The lack of a single convincing model of physician response makes it difficult to generalize the findings to another freeze. Only a slow cumulative reduction in volume in the negative direction would give us confidence in generalizing the results to renewed freezes in the future. An erratic time path of responses predicated on a combination of uncertainty, backward bending supply, and perhaps demand inducement as well would make forecasting unreliable and difficult.

A final question of generalizability is more technical. To what extent can we generalize our findings based on four states and 25 localities to 50 states and 240 localities? Several precautions have been taken to make the results as universal as possible. First, our four states represent the four Census regions of the country with varying degrees of urbanness, per capita income, and physician availability. Second, we have noted important state differences in the descriptive results where they exist. And third, we have employed an econometric technique that explicitly controls for the initial expenditure and volume levels in each locality to avoid confounding temporal trends with cross-sectional differences. Because the general pattern of results seems to hold across most types of service, and in most states in our sample, we feel reasonably confident in extending them to other areas--at least qualitatively if not in exact magnitude.

4.5 Specification and Econometric Issues

4.5.1 Dependent Variables

The dependent variables used in the regression analysis originate from the following identity:

$$(Exp/Bene)/MCRI \equiv (Q/Bene)*(Complex) \qquad (4\text{-}1)$$

(Exp/Ben) = expenditures per beneficiary in nominal dollars

(MCRPI) = an index of allowed Medicare prices

(Q/Bene) = quantity of services per Medicare beneficiary (in raw counts), and

(Complex) = an index of the average complexity of Medicare services provided, where complexity is measured by the average real price of a service.

The overall impact of the freeze on the measured quantity of care can be assessed by applying our research methodology to analyzing allowed charges deflated by a Medicare price index. When deflated by the Medicare price index, allowed charges take on the dimension of real weighted quantities.

Next, specific insights into what is driving the results on weighted quantities can be gleaned by decomposing the weighted quantities into the product of raw numbers of services multiplied by their average complexity. This product is given on the right side of equation (4-1). Thus, for example, it is important to know whether the freeze's impact on weighted quantity is reflected strictly in the trend in the raw number of services provided, or whether the freeze affects the reported complexity of services as well. Reported complexity would increase, for example, if physicians engaged in any deliberate upcoding as a sort of gaming response to the freeze.

We have measured our dependent variables as follows. First, measures of allowed charges per Medicare enrollee have been constructed at several levels of aggregation. In particular, we measured and analyzed deflated total allowed Medicare charges per beneficiary as well as disaggregated by type of service. The price deflator used for deflation is based on a Medicare price index constructed from the average measured prices of a selected market basket of physician services. This index was originally constructed at the specialty level and subsequently aggregated for selected parts of our analysis.

As noted earlier, when deflated by this index, allowed charges take on the dimension of real or weighted quantity. This interpretation is based on the assumption that base period prices are proportional to the real amount of care which a given service delivers. When subsequent intertemporal movements in the price of care are deflated out, what remains is a measure of the weighted quantity of care delivered.

For our purposes, this means that the econometric work which follows assesses quantity-related effects of the freeze only, leaving the effects of the freeze on real price as an exogenous program-determined variable. In order to calculate the overall dollar savings to the Part B program, the effect of the freeze in reducing real prices must be added together with its effects on real quantity. The sum of these percentage effects gives the net percentage effect of the freeze on Part B expenditures.

Next, we constructed measures of units of service consumed per Medicare beneficiary. Formally speaking, quantity is defined as a single HCPCS unit of service, e.g., brief office visit. While this measure is an unweighted aggregation of widely differing services, it provides some insights into whether expenditures are being "quantity" or "complexity" driven. As in the case of allowed charges, quantity per enrollee measures were also disaggregated down to the type of service level.

Finally, some attempts were also made to track the changing complexity of services over the interval of the fee freeze. At this point, the complexity index has only been constructed for two types of service, hospital and office visits. The methodology used to construct these complexity indices was quite simple. First, a set of base period, pooled (four-state) prices were constructed for each type of hospital and office visit. These prices were defined as the simple sum of deflated charges for each type of visit divided by the sum of visits of that type, where the sums are computed across all four states. Next, a weighted average price of all base period visits was generated by weighting prices by the proportion of each type of visit. This weighted average price was subsequently divided by itself to produce an index where the first quarter value of the national index equalled one. For subsequent quarters, base period prices were used to weight that specific quarter's visit mix. Current quarter values of the index were finally divided by the base period weighted average visit price to get each quarter's value of the index. Intertemporal variation in the index is solely attributable to a change in the proportions of each type of visit. Thus, for example, the pooled index grows over time only if the proportion of visits becomes more heavily weighted towards visits with greater base period prices.

Locality-specific analogs to the pooled hospital and office visit indices can easily be constructed as well. As before, we use the weighted average national visit price in the denominator. The difference is that now the numerator is formed as the weighted average visit price <u>within</u> the locality in any given period. Base period national prices are multiplied by the locality and quarter-specific visit proportions to generate the weighted average locality visit price within any given quarter. This generates the numerator in the index. When divided by the denominator, the result is a locality-specific index of upcoding which varies across locality and over time.

4.5.2 Independent Variables

Freeze Variable

As noted above, the effect of the freeze on Part B expenditures is captured through its associated effect on another variable, the real Medicare allowed charge (RMAC). That is, the fitted coefficient on RMAC is combined with the effect of the freeze on RMAC to assess the overall effect of the freeze on Part B expenditures.

Formally speaking, the RMAC is defined as the ratio of the Medicare price index (defined above) divided by a consumer price index. The consumer price index utilized in this computation is based on a standard cost of living index constructed, one a one time basis, at the SMSA level. Intertemporal variation in this deflator was subsequently generated at the four region level.

When this quotient is computed, the resulting RMAC is a measure of the real price physicians receive for treating Medicare patients. This variable, as argued earlier, is the theoretically correct measure to include in the Part B expenditure regressions, since in theory physicians respond to real prices rather than the freeze per se.

Intertemporal trends in this index were given in Table 3-1. Note that over the freeze period, particularly quarters 7-13, the index of real charges shows a steady, gradual decline, representing the eroding effects of inflation. Subsequently, the index "picks up" reflecting the May 1986 update to physicians who signed the participation agreement.

In order to deal with the possibility that physicians respond to this variable with a lag, a lagged value of RMAC was included. The procedure for estimating this lag structure is discussed below.

Covariates

Each of the dependent variables defined above were analyzed in a quasi-experimental or reduced-form regression format. The implicit assumption, of course, is that the right side of all such regressions contains the full complement of exogenous variables affecting the dependent variable. This criterion makes it incumbent of us to include a wide variety of variables in our regression.

The included variables in the regression can be logically divided into a number of categories, including general controls for the costs of providing care, the costs of seeking treatment, and non-Medicare demand, as well as controls for the effects of Medicare's Prospective Payment System.

The costs of seeking care on the part of Medicare consumers, over and above deductibles and copays, should also affect the level of Medicare weighted and unweighted quantities per capita. To control for the time costs of seeking care, we have included a control for the locality's urban/rural

status (percent of population living in an SMSA). Assuming physicians are more accessible in urban areas, even holding relative supplies constant, we expect the sign of this variable to be positive.

In addition, a measure of the number of physicians per capita (MDPOP) in the locality was also included under the hypothesis that greater numbers of physicians improve patient access. This, too, should have a positive sign.

Next, it is also important to control for the level of demand on the non-Medicare side to the extent possible. One such control is a measure of real per capita income in the locality (PCY). Per capita income directly affects Medicare demand in a positive fashion and may also proxy a given geographic area's ability to "support" high technology, intensive modes of medical care. Thus, per capita income is also likely to "pick up" the effects of omitted trends in technology growth. For these reasons, the predicted coefficient on this variable is positive. Second, we have also included a control for the extent of HMO penetration in the locality (HMO). Greater HMO penetration should reduce demand on the non-Medicare side and thus increase Medicare expenditures and quantities. While this seems reasonable on a temporal basis, HMO-intensive areas historically may have had a more-or-less physician-intensive mode of practice that spills over into the treatment of non-HMO Medicare patients as well. Hence, the sign of HMO is ambiguous.

Finally, we have also included controls for the effects of PPS on Part B expenditures using Medicare inpatient days per beneficiary. The dominant effect of PPS should be a reduction in the number of inpatient days. Consequently, the associated effects on Part B expenditures depend on whether inpatient days are a substitute for or a complement with Part B physician expenditures. As a substitute, the introduction of PPS should stimulate Part B expenditures and vice versa if they are complementary. Inpatient physician visits are one example of a substitute which should definitely decline post-PPS while outpatient visits should increase.

In order to fully capture the effects of changing levels of inpatient days on Part B expenditures, we have included several lags of this variable as well. There are a number of reasons for doing this. First, patients not treated in the hospital may have their episode of illness extended somewhat, so that the effects of an avoided inpatient day on physician services may not be fully realized until some time thereafter. Second, an avoided inpatient day may induce physician to change their practice in fundamental ways, adding new office equipment and establishing new referral networks, each of which may change aggregate Part B expenditures. Since these changes take some time to implement, the actual relationship between an avoided inpatient day and the resulting changes in Part B expenditures is likely to be a lagged relationship. Again, the mechanics of estimating a lag structure are discussed below.

4.5.3 Estimation Method

Several important econometric issues need to be addressed before proceeding to a discussion of the results. The first of these is how to derive unbiased, efficient estimates using a pooled cross-section time-series of localities in four states. A second problem is the issue of dynamics, a question to which we have already briefly alluded. In particular, we hypothesize that a number of our key variables affect the dependent variables with a lag. The issue, then is how to best acknowledge this fact in our methodology. A third issue is how to deal with the problems of multicollinearity in a way which does not bias our estimates. Finally, we also had to deal with problems arising from seasonal trends in our data.

Consider, first, the panel data issue. Prevailing wisdom suggests that the variance/covariance matrix of the disturbances is unlikely to be scalar (i.e., not identically and independently distributed) due to the existence of locality-specific effects which persist over time. The important question which arises in this context is whether to use a random effects or a fixed effects model.

Recent theoretical developments in the area of panel data indicate that the choice of random or fixed effects models should be guided initially by a statistical test of the equivalence of the two models. Rejection of this equivalence is thought to be a rationale for choosing the fixed effects approach (Hausman, 1978), although the presence of errors in variables may mitigate this conclusion.

In particular, differences between the random and fixed effects results can be due to one of two qualitative reasons. First, the so called left out effect associated with the locality may be correlated with other included variables. In such a case, the random effects model, which does not fully purge these effects from the residual, will yield biased results and differ from the fixed effects model which explicitly controls for each locality. Alternatively, the left out effect may not be correlated with the residual, but the data's time series variation may be beset by substantial errors-in-variables. In this case, the random and fixed effects differ because the fixed effects are biased.

In general, it is difficult, if not impossible, to say why the fixed and random effects differ, supposing that they do. Thus, our approach in this study was to report results from the random effects model in order to exploit the cross sectional variation in some of our key variables, and to deal most effectively with the problem of collinearity (see discussion below).

The second question we had to deal with was how to specify the dynamics of the economic relationships we estimated. One approach to estimating the lag structure is through the use of a partial adjustment model. However because the analysis was conducted quarterly, the partial adjustment model was unable to sort out the quarterly effects of the various explanatory variables.

Still another approach is to estimate a finite lag structure using a polynomial restriction such as the Almon method. A polynomial restriction is commonly applied to address the collinearity which exists within the various lags (i.e., successive lagged values are likely to be highly correlated with one another). Unfortunately, because of the complex algorithms involved in estimating the random effects model, we were unable to apply the Almon method to our model.

Thus, our approach was to account for dynamics in the economic relationships by inserting a number of finite lags where we deemed it necessary. In particular, we included four lags of the inpatient days variables and a single lag of our real Medicare allowed charge (RMAC) variable, based on the statistical significance of the estimated lags. The general form of the estimated equation was:

$$Y_{kt} = \alpha' X_{kt} + \varphi' l(MIPD) + \phi' l(RMAC) + e_{kt}$$

where

Y_{kt} = value of the dependent variable, e.g, expenditures in the k-th locality in the t-th quarter;

X_{kt} = vector of unlagged exogenous explanatory variables specific to the k-th locality and t-th quarter;

$l(MIPD)$ = vector of current and lagged values of Medicare inpatient days per capita specific to the k-th locality and the t-th quarter;

$l(RMAC)$ = current and lagged values of the real Medicare allowed charges specific to the k-th locality and the t-th quarter;

E_{kt} = random error term for the k-th locality and the t-th period;

Third, the issue of collinearity also needed to be addressed. The collinearity arises, quite naturally, because the series of controls utilized on the right hand side are time series in nature. Our strategy for dealing with the issue was to make use of cross sectional variation in our variables wherever possible. In particular, use of the random effects procedure enables us to exploit cross sectional variation in variables such as inpatient days and the real Medicare allowed charge (RMAC).

Finally, we also had to deal with the problem of seasonality in some of our independent variables. Specifically, measures of inpatient days, one of our key controls for PPS, tend to fall in the fourth quarter of each year due to the reluctance of patients and physicians to use the hospital over the major holidays. This trend can reduce the efficiency of our estimates since we hypothesize that our dependent variable reacts with a lag to long term rather than seasonal trends in this variable.

In order to deal with this problem, we seasonally adjusted the inpatient days measure by interpolating between third quarter and first quarter values to get a revised fourth quarter measure. In addition, we included a fourth quarter dummy in the regression to recognize that seasonal reductions in inpatient days may affect fourth quarter expenditures only.

4.6 Empirical Results For Part B Physician Expenditures Per Beneficiary

4.6.1 Total Expenditures Per Beneficiary

Table 4-1 includes a set of variable definitions and means, aggregated over 25 localities and 16 quarters spanning the 1983-1986 period. For instance, deflated total physician expenditures per beneficiary per quarter averaged $117.38 (in 1983 dollars).

Table 4-2 presents results of the regressions of deflated total expenditures per Medicare beneficiary. Random effects results are reported here. Ordinarily, a test of equivalence of random and fixed effects results would be performed in order to see if the left out locality effect was correlated with any of the included variables. However, differences between the random and fixed effects results can be due to a variety of statistical problems, including endogeneity of the panel data effects as noted above or because of errors in measurement of intertemporal variables. In the former case, the random effects are biased and so the fixed effects results are preferred. In the latter case, the fixed effects, which rely exclusively on intertemporal variation, are strongly biased and so the random effects are preferred. Given this fundamental ambiguity, we have chosen to present only the random effects results for reasons given above.

Turning to the results in Table 4-2, we note several important findings about the implied effect of the fee freeze on physician expenditures. First, and most importantly, the regression fits a negative coefficient for the real Medicare allowed charge as well as its lag. Given that the key policy impact of the fee freeze was a reduction in the RMAC, it follows that the net effect of the fee freeze was an increase in real Medicare quantities, ceteris paribus. This finding is consistent with the hypothesis that physician supply is backward bending, and that reduction in the RMAC moves the physician down along his supply schedule, encouraging even greater supply. This occurs, in turn, because income targeting physicians are more affected by the freeze's reduction in their real incomes than by the price incentives to move out of the Medicare business. Thus, they increase quantity to maintain income. The finding is also consistent with the hypothesis that the freeze stimulated demand in demand constrained markets. Which of these two hypotheses was most involved in the increased cannot be ascertained at this point, however.

TABLE 4-1

TABLE OF MEANS AND VARIABLE DEFINITIONS

Variable	Definition	Mean	Standard Deviation
Expenditures/ Beneficiary	Deflated total expenditures per Medicare beneficiary	$117.38	55.51
Services per beneficiary	Total number of services of all types per Medicare beneficiary	3.17	1.24
RMAC	Index of real Medicare allowed charges	$0.99	0.09
Medicare Hospital Days	Total number of Medicare inpatient days per Medicare beneficiary	0.79	0.31
Per Capita Income	Deflated income per capita, in thousands	11.48	1.90
HMO Enrollment Per Capita	Total HMO enrollment per 100 population	8.32	13.61
Physicians Per Capita (MDPOP)	Number of patient care MDs per 100 population	0.16	0.08
Percent Urban	Proportion of population living in an SMSA	0.67	0.35
Quarter 4	Dummy variable; coded as one in quarters 4, 8, 12, and 16; zero otherwise	0.25	0.43

Note: All of these variables are specified at the locality level except TIME and FREEZE which are national.

Source: Medicare Part B claims for Alabama, Connecticut, Washington, and Wisconsin, 1983-1986.

TABLE 4-2

REGRESSION RESULTS FOR TOTAL DEFLATED PART B EXPENDITURES[a]: RANDOM EFFECTS
(STANDARD ERRORS IN PARENTHESES)

	Random Effects	
Index: Real Medicare Allowed Charge (RMAC)	-39.48	(27.92)
Lag 1 (RMAC)	-46.78*	(27.19)
Medicare Hospital Days/Pop (MHDP)	10.43***	(4.29)
Lag 1 (MHDP)	13.83	(12.78)
Lag 2 (MHDP)	3.54	(17.47)
Lag 3 (MHDP)	-33.79**	(17.59)
Lag 4 (MHDP)	-15.87*	(9.88)
Per Capita Income (PCI)	0.004***	(0.001)
HMO Enrollment/Population (HMOPOP)	-0.378***	(0.16)
Physicians/Population (MDPOP)	289.56**	(133.81)
Percent Urban	189.42***	(39.20)
Quarter 4	-1.14	(1.19)
R^2	.71	
F	57.73	
DF	288	

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B claims from Alabama, Connecticutt, Washington, and Wisconsin, 1983-1986.

The sum of the current and lagged coefficients is -85 which implies an elasticity at the mean between RMAC and real Part B expenditures of approximately -0.80. Note, however, that the RMAC attains statistical significance only in lagged form. Based on the variance/covariance matrix of the regression coefficients, we calculated the standard error of the sum of the current and lagged coefficients to be approximately 50. This means that we are 95 percent confident that the true summed effect lies between -180 and 20 (points estimate +- twice the standard error). Moreover, this sum is statistically different from zero at the 10% confidence level.

In a qualitative sense, these results imply that the fee freeze lead to an increase in Part B quantities. Note, however, that this does not imply that the freeze resulted in increased program expenditures. The percentage reduction in real Medicare price must be subtracted from the percentage increase in quantities in order to calculate the net effect of the freeze on Part B quantities. Since, according to our best estimate, the positive elasticity of quantity response to a 1 percent decline in real price was only 0.8 percent, it follows that the freeze generated program savings of 0.2 percent (1 - .8) for ever 1 percent drop in the real RMAC brought about by the freeze.

The other notable finding in Table 4-2 is the prominent role that the lagged structure of inpatient days plays in determining the level of Part B expenditures. Specifically, the pattern of lagged coefficients is a series of gradually declining positive coefficients followed by negative coefficients. This implies that a reduction in inpatient days leads, initially, to a reduction in Part B expenditures (positive coefficient multiplied by a negative change). Over time, however, the lagged effect is an increase in Part B expenditures (negative lagged coefficients multiplied by a negative change).

More importantly, on net, the long run effect of declining inpatient days is an increase in Part B quantities. This follows from the fact that the sum of the lagged coefficients is -22 (=10 + 14 + 4 - 34 - 16). In terms of joint significance, the standard error of the summed current and lagged coefficients is 19. This implies that (1) we are 95% confident that the true sum is between -60 and 16 and (2) that the net sum is not statistically different from zero. On the other hand, individual lagged values are statistically significant as well as other subsets of the lagged coefficients. In other words, a finding that the net sum is not statistically different from zero does not imply that each and every lag is zero. Indeed, a definite pattern of lagged effects exists here which conform to prior expectations.

The simple interpretation of this result is that Medicare inpatient days are a long term substitute for rather than a complement with Part B expenditures. This substitutability, in turn, may exist for a couple of reasons. First, imagine a specific episode of illness and consider the point

in time at which the patient seeks care but is denied access to the hospital. Immediately, the patient is likely to seek compensating care from the physician. However, if this substitute care does not adequately compensate for the failure to hospitalize, the patient may require additional care from the physician over an extended period of time, thus accounting for the lag between inpatient days and Part B expenditures (say, a couple of quarters). This scenario seems especially applicable to certain medical conditions in the elderly such as pneumonia or congestive heart failure.

Second, consider the physician faced with a patient whom he would like to admit but cannot due to restrictions imposed by PPS. His immediate preference may be to treat such episodes in his office or via referrals, but it may take him time to establish new referral networks, hire additional staff, purchase new diagnostic equipment, etc. The net result, again, is a distributed lag (perhaps longer this time) between the decline in inpatient days and the point at which Part B expenditures start to grow.

Note, finally, that in some cases Part B expenditures may be stimulated by decreases in inpatient days for reasons other than the simple substitution of physician for hospital care. It is likely, for example, that reductions in inpatient days have helped to spur the growth of outpatient facilities, either free-standing or hospital based. In turn, the growth in outpatient facilities may be contributing to the growth in selected procedures for reasons of improved access or reduced time price per se. Indeed, given the concentration of expenditure growth in the areas of surgery and specialty care noted in Chapter 3, this latter avenue of causality seems to be the most plausible explanation for the substitutive relationship which is suggested by the regression. If so, then the direct role of PPS in the Part B increase is less certain and well defined, needing additional inquiry.

As for the other variables or controls used in our analysis, real per capita income is positive and significant with an elasticity at the mean calculated as .39. As noted earlier, we hypothesize that part of this coefficient reflects the fact that per capita income proxies the area's ability to attract medical resources and technologies, at least cross-sectionally. Conversely, HMO market share is negative and statistically significant as expected, with an elasticity at the mean of .03.

Finally, variables included to measure the time cost of seeking care also behave in the expect manner. Increases in physicians per capita increase quantity with a plausible elasticity at the mean of .44. Likewise, urbanization has a statistically significant positive effect on quantity, also presumably because of easier access. Its elasticity at the mean is 1.05. Again, the magnitude of this number may partially reflect the ability of urban areas to attract medical resources and technologies.

4.6.2 Total Weighted Quantity By Type of Service

Table 4-3 presents results of the regressions of total weighted quantity broken out by type of service category. As in our descriptive work, eight service categories have been used for this task.

Note, first, that the pattern of freeze effects uncovered in the overall work does not generally hold for type of service disaggregation. Specifically, only three of the eight services show negative values for both the current and lagged coefficients of RMAC. In four of the remaining five regressions, one coefficient on RMAC is positive and the other negative. It is clear, in other words, that the results found in the overall regression represent a weighted average of the current and lagged coefficients of RMAC by type of service where regressions with negative values are more heavily weighted. This yields the strictly negative pattern of coefficients on RMAC found in the overall work.

On the other hand, one finding which is somewhat robust to type of service disaggregation is that the summed value of the current and lagged coefficients on RMAC is negative, indicating that physicians are income targeters or that the freeze stimulated demand. This finding holds for five of the eight type of service regressions, the exceptions being medical care, assistant surgery, and lab tests. One explanation for the exceptions could be that these are services where physicians are not targeting income or find it difficult to locate additional pockets of demand to fill. Assistant surgery and lab tests, furthermore, were both subject to other payment changes during this period, changes that were unrelated to the freeze.

Finally, one finding which we can safely say is verified in the type of service disaggregation is that there is little evidence that RMAC relates positively, on net, to Part B expenditures. Even for those types of services where the net RMAC effect is positive, the net magnitude is small and insignificant (e.g., for medical care, the net effect is 19.4-15.2 = 4.2 which is statistically insignificant based on a test of joint significance). In short, we find little evidence in the type of service disaggregation that the freeze reduced weighted quantities.

Next, note that the effects of inpatient days on Part B quantities are also duplicated in the type of service disaggregations. In each of the regressions, except surgery and assistant surgery, the familiar pattern of positive followed eventually by negative lagged coefficients is repeated for the inpatient days variable. Moreover, the sum of the current and lagged coefficients is negative in all of the regressions with the exception of lab tests. Thus, our finding regarding the effects of inpatient days on Part B quantities is robust to type of service disaggregation.

Next, note that most of the other cross-sectional controls, including HMO share, urbanization, and MDPOP continue to behave as expected in the type of service disaggregations. The lone exceptions are the HMO share coefficient

TABLE 4-3

TOTAL DEFLATED PART B EXPENDITURES[a]: BY TYPE OF SERVICE

	Medical Care	Consultations	Special Tests
Index: Real Medicare Allowed Charge (RMAC)	-15.17*	-1.69*	1.10
Lag 1 (RMAC)	19.36**	-0.58	-6.98***
Medicare Hospital Days/ Pop (MHDP)	2.81**	0.42***	0.71*
Lag 1 (MHDP)	7.68**	1.15	0.31
Lag 2 (MHDP)	-4.64	-0.49	0.81
Lag 3 (MHDP)	-9.01	-0.30	-4.00***
Lag 4 (RMAC)	-2.09	-0.91***	-0.36
Per Capita Income (PCI)	4.1E-4	7.1E-5	0.001***
HMO Enrollment/ Population (HMOPOP)	-0.16***	0.02***	-0.01
Physicians/Population (MDPOP)	98.85***	10.12**	23.93**
Percent Urban	24.73**	4.94***	3.58
Quarter 4	-0.55	-0.98**	0.07
R^2	.64	.69	.75
F	42.64	52.57	70.99
DF	288	288	288

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B claims from Alabama, Connecticutt, Washington, and Wisconsin, 1983-1986.

TABLE 4-3 (continued)

TOTAL DEFLATED PART B EXPENDITURES[a]: BY TYPE OF SERVICE

	Surgery	Assistant Surgery	Anesthesia
Index: Real Medicare Allowed Charge (RMAC)	19.14	3.95***	-0.33
Lag 1 (RMAC)	-44.62***	0.97	-4.43***
Medicare Hospital Days/ Pop (MHDP)	2.96	0.66***	0.28
Lag 1 (MHDP)	-2.75	-2.40***	0.78
Lag 2 (MHDP)	2.78	1.73*	-0.94
Lag 3 (MHDP)	-10.94	-3.56***	-0.24
Lag 4 (MHDP)	-8.87**	0.18	-0.80
Per Capita Income (PCI)	.001	-0.001***	4.8E-6
HMO Enrollment/ Population (HMOPOP)	-0.12*	-0.02***	-0.02***
Physicians/Population (MDPOP)	122.83**	28.75***	32.91***
Percent Urban	78.62***	2.06	8.26***
Quarter 4	-0.17	-0.09	-0.02
R^2	.66	.25	.63
F	46.94	7.89	41.49
DF	288	288	288

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B claims from Alabama, Connecticutt, Washington, and Wisconsin, 1983-1986.

TABLE 4-3 (continued)

TOTAL DEFLATED PART B EXPENDITURES[a]: BY TYPE OF SERVICE

	Radiology	Lab Tests
Index: Real Medicare Pop (MHDP)	-2.57	-0.61
Lag 1 (RMAC)	-4.80	0.81***
Medicare Hospital Days/Pop (MHDP)	0.64	0.32
Lag 1 (MHDP)	1.48	2.95***
Lag 2 (MHDP)	1.87	0.01
Lag 3 (MHDP)	-5.23*	0.12
Lag 4 (MHDP)	-1.63	-1.48***
Per Capita Income (PCI)	-0.001***	1.9E-4
HMO Enrollment/Population (HMOPOP)	-0.03	-0.02***
Physicians/Population (MDPOP)	71.59***	10.03*
Percent Urban	3.72	-3.16*
Quarter 4	-0.45**	-0.13**
R^2	.69	.43
F	54.65	17.91
DF	288	288

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B claims from Alabama, Connecticutt, Washington, and Wisconsin, 1983-1986.

in the consults regression and the urbanization coefficient in the lab tests regression. In addition, the magnitude of coefficients on key variables such as MDPOP are consistent with the relative size of the type of service in question. For example, the elasticity at th mean MDPOP is .43 in the medical care regression and .46 in the surgery regression.

One surprise in the type-of-service disaggregations is the relatively small coefficients and levels of significance associated with the per capita income variable. This holds for the most part in all the type of service regressions with the exception of special tests. At this point in time, we have no explanation for the declining role of this variable in the type of service disaggregations, particularly since the relative magnitudes of the other variables are unaffected by type of service disaggregation.

4.7 Regression Results for Quantity of Service

Growth in weighted quantity over the sample period can be divided into two fundamental categories: (1) growth in total number of services; (2) and growth in the coded complexity of those services. As a first step towards further understanding the effects of the freeze on total weighted quantity noted earlier in this chapter, we analyzed the effects of the freeze on the total number of services per Medicare beneficiary.

The purposes here are three-fold. First, we would like to know if the quantity of services provided was affected by the freeze in the same qualitative manner as total deflated expenditures. A second issue we wanted to explore was the question of whether the effects of the freeze were concentrated in any single area of service. Finally, the results of this section offer some insights, perhaps, into how the freeze affected physician behavior. If, for example, most, if not all, of the fitted effects of the freeze on weighted expenditures can be explained by measured effects on quantity, then our theoretical focus must be here rather than in the area of upcoding. Of course, the phenomenon of upcoding is also analyzed in specific detail in Section 4.8.

Before turning to the results, note that our dependent variable, quantity of services per Medicare enrollee, represents a aggregation over very dissimilar types of services and amounts to a summation of "apples and oranges." Some may see this as troublesome, since presumably intertemporal trends in numbers of services could be affected by the mix of different types of services over time (e.g., one complex service may replace two less complex services or vice versa). However, our attempts to capture the partial effect of the freeze on the quantity of services provided should not be affected by this problem. Specifically, any random movements in quantities which is due to changes in the service mix should fall into the error term of the regression. Thus, we should be able to assess the systematic effects of the freeze on total quantity of services provided, holding changes in the mix of

services constant. Of course, to the extent that the mix of services is more stable and homogeneous within disaggregated categories such as type of service, our estimates should be more efficient if not less biased under disaggregation.

4.7.1 Overall Regression Results for Total Quantity of Services

The regression results of the overall number of services per Medicare enrollee are given in Table 4-4. As in the case of total charges, random effects results are presented in the overall work.

Turning to the results, note first that the measured effect of RMAC, the real Medicare allowed charge, is ostensibly somewhat different than what we found in the overall results of weighted quantity. Here, the coefficient for the unlagged variable is significantly negative (it was insignificant in Table 4-2) and th lagged value is insignificant positive (it was significant negative in 4-2). This is not surprising taking into account the fact that a fair amount of collinearity remains between the current and lagged values of RMAC, making the distribution of the coefficient across its current and lagged values somewhat unstable.

The more relevant value is the sum of the current and lagged coefficients (which is not affected by collinearity) and what the sum implies for the percentage change in raw quantities over the freeze period. The sum is -1.62, which again indicates that the freeze, by lowering the RMAC, helped to stimulate the number of Part B services delivered over the freeze interval.

Next, note that the lag structure of Medicare inpatient days per capita is also similar to that which was found in the weighted quantity regression. The regression evidences a pattern of positive coefficients followed by a pattern of negative coefficients with the sum of current and lagged coefficients netting out to a negative value. More specifically, the sum is $-.78 = (.22 + .61 - .21 - 1.23 - .17)$.

Finally, note that other controls also behave generally as expected with just a few exceptions. It is worth pointing out that the MDPOP effect is insignificant with a relative small elasticity compared to before (.08 here compared to .44 in Table 4-2). This may indicate that in the weighted quantity regression MDPOP simply proxied the tendency of physician-intensive regions to attract new technologies. Since new technologies are less apt to affect the quantity of services provided, per capita income is relatively less important in this regression.

Variables such as per capita income, urbanization, and HMO enrollment also have the same signs and levels of statistical significance as in Table 4-2. The elasticities at the mean are also comparable to Table 4-2 (.28 for per capita income, .025 for HMO enrollment and 2.00 for urbanization). Thus, we interpret the effects of these variables the same way as we did in Table 4-2.

TABLE 4-4

REGRESSION RESULTS FOR TOTAL NUMBER OF SERVICES: RANDOM EFFECTS

	Random Effects
Index: Real Medicare Allowed Charge (RMAC)	-2.69***
Lag 1 (RMAC)	1.07
Medicare Hospital Days/Pop (MHDP)	0.22**
Lag 1 (MHDP)	0.61**
Lag 2 (MHDP)	-0.21
Lag 3 (MHDP)	-1.23***
Lag 4 (MHDP)	-0.17
Per Capita Income (PCI)	8.0E-5**
HMO Enrollment/Population (HMOPOP)	-0.01***
Physicians/Population (MDPOP)	1.74
Percent Urban	4.94***
Quarter 4	-0.03
R^2	.63
F	40.67
DF	288

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B claims from Alabama, Connecticutt, Washington, and Wisconsin, 1983-1986.

4.7.2 Number of Services by Type of Service

Table 4-5 presents the regressions of total numbers of services broken out by type of service. The purpose here is similar to the analysis of weighted quantity by type of service. That is, we would like to know if the pattern of RMAC and inpatient days effects are robust to this type of disaggregation.

Given that we found a robust set of freeze effects with no particular concentration by type of service under weighted quantity, it would be somewhat surprising not to find the same thing here. However, it is theoretically possible for our overall result on numbers of services to be concentrated within particular types of services. If this were the case, it would imply a changing service complexity across the various types of services to explain the fact that for some services the freeze affected overall weighted quantity but not numbers of services.

Turning to the results, note first that the current and lagged values of RMAC show the same sort of volatility when disaggregated by type of service that we intitially saw in Table 4-3. As a general rule the current and lagged coefficients of RMAC are of opposite sign (this occurs in five of the eight regressions), with no regular pattern as to which is negative or which is positive. Moreover, the net sum of the current and lagged coefficients is negative in half of the regressions and positive in half of the regressions. The negative effect of RMAC comes through for consultations, special tests, anesthesia, and radiology. These are apparently the services for which the freeze stimulated the number of services offered working through the principle of income targeting. For medical care, surgery, and assistant surgery, on the other hand, a relatively small positive net coefficient is found, indicating that the freeze may have slightly depressed the number of these services offered, although the effect is quite small. On net, then, perhaps the only universal conclusion which can be drawn is that there is little evidence that the freeze significantly reduced the numbers of any type of service. (The reduction in lab tests undoubtedly reflects the direct billing requirement implemented at the same time as the freeze.) More is said about this below.

Note, also, that the lag structure of inpatient days follows the familiar pattern of initially positive coefficients followed by negative, lagged coefficients. The only clear exceptions to this pattern are surgery, assistant surgery, and anesthesia, where initially negative coefficients precede positive lagged values. Note, in addition, that the other controls in the regression generally conform to expectations with physicians and urbanization increasing services and HMO penetration decreasing services.

TABLE 4-5

REGRESSION RESULTS FOR TOTAL NUMBER OF SERVICES: BY TYPE OF SERVICE

	Medical Care	Consultations	Special Tests
Index: Real Medicare Allowed Charge (RMAC)	-1.21***	-0.03*	0.05
Lag 1 (RMAC)	1.35***	-0.01	-0.14
Medicare Hospital Days/ Pop (MHDP)	0.13***	0.01***	0.06***
Lag 1 (MHDP)	0.45***	0.03***	0.05
Lag 2 (MHDP)	-0.29	-0.01***	-0.01
Lag 3 (MHDP)	-0.48***	-0.01***	0.03
Lag 4 (MHDP)	0.06	-0.01***	0.03
Per Capita Income (PCI)	-2.6E-5*	6.7E-7	1.9E-5
HMO Enrollment/ Population (HMOPOP)	-0.01***	3.7E-4***	-0.002***
Physicians/Population (MDPOP)	0.87	0.07	1.01***
Percent Urban	2.27***	0.09***	0.10
Quarter 4	-0.02*	6.4E-4	0.003
R^2	.61	.61	.62
F	38.54	37.07	39.59
DF	288	288	288

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B claims from Alabama, Connecticutt, Washington, and Wisconsin, 1983-1986.

TABLE 4-5 (continued)

REGRESSION RESULTS FOR TOTAL NUMBER OF SERVICES: BY TYPE OF SERVICE

	Surgery	Assistant Surgery	Anesthesia
Index: Real Medicare Allowed Charge (RMAC)	0.43***	5.6E-4	0.02
Lag 1 (RMAC)	-0.39***	.005	-0.08
Medicare Hospital Days/ Pop (MHDP)	0.03***	0.002***	-0.04
Lag 1 (MHDP)	-0.07*	-0.004*	-0.12*
Lag 2 (MHDP)	0.08	0.006*	-0.05
Lag 3 (MHDP)	0.01	-0.008***	0.07
Lag 4 (MHDP)	-0.13***	0.005***	0.07
Per Capita Income (PCI)	1.7E-5***	3.4E-7*	3.8E-6
HMO Enrollment/ Population (HMOPOP)	-6.8E-4	-1.6E-5	-0.002***
Physicians/Population (MDPOP)	0.53	-0.03**	0.48
Percent Urban	0.11	0.01***	0.04
Quarter 4	-0.01***	-2.1E-4	-0.01
R^2	.65	.48	.15
F	44.14	21.82	4.08
DF	288	288	288

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B claims from Alabama, Connecticutt, Washington, and Wisconsin, 1983-1986.

TABLE 4-5 (continued)

REGRESSION RESULTS FOR TOTAL NUMBER OF SERVICES: BY TYPE OF SERVICE

	Radiology	Lab Tests
Index: Real Medicare Allowed Charge (RMAC)	-0.86***	0.26**
Lag 1 (RMAC)	0.16	-0.04
Medicare Hospital Days/Pop (MHDP)	0.02	0.02
Lag 1 (MHDP)	0.07	-0.01
Lag 2 (MHDP)	-0.04	0.11
Lag 3 (MHDP)	-0.43***	-0.20***
Lag 4 (MHDP)	0.14**	-0.09**
Per Capita Income (PCI)	1.1E-5	1.4E-5**
HMO Enrollment/Population (HMOPOP)	-0.01***	-8.9E-4
Physicians/Population (MDPOP)	2.19***	1.26**
Percent Urban	1.19***	-0.10
Quarter 4	-0.002	-0.01***
R^2	.62	.63
F	39.71	41.11
DF	288	288

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B claims from Alabama, Connecticutt, Washington, and Wisconsin, 1983-1986.

4.8 Analysis of Upcoding

Our original expectation was that both the freeze and the shift of services out of the hospital would increase the average complexity of physician services, either because physicians are "gaming" the system or because they are called on to deliver more acute level care. However, it is important to note that these trends are offset, to some extent, by the increase in routine care delivered either to maintain physician incomes or to perform routine tasks (monitoring patient progress, etc.) previously done in the hospital. This added level of routine care tends to decrease the average complexity of reported services. In short, any trends in average complexity driven by deliberate upcoding, technology, or PPS are apparently buried in the opposite trend toward delivering greater quantities of routine, less complex care as well. The net effect is that little in the way of average service complexity can be attributed either to the freeze or to the decline in inpatient days.

To some extent, our work in the area of raw quantities enables us to assess the average growth in the reported complexity of services. The fact that raw quantities were affected by the freeze and PPS in much the same way as weighted quantities argues that average complexity has not changed. In this section, we extend the analysis of average complexity by examining trends in this variable more directly.

This is done is two ways. First, a more aggregated index of the measure of physician upcoding is presented for the case of hospital and office visits. (See Section 4.5.1 for a discussion of how the index was created.) Our upcoding index is comprehensive in that it incorporates the universe of visits across the four states. Second, a regression analysis approach is utilized to measure the individual determinants of hospital and office visit upcoding. Specifically, the regression approach enables us to determine if some part of the time trend in visit upcoding can be specifically assigned to the freeze.

4.8.1 Descriptive Trends in Upcoding

Table 4-6 presents overall trends in the extent of upcoding for both hospital and office visits, overall and by state. It provides evidence of systematic upcoding across each of the four states between 1983 and 1986. However, the pooled (four-state) trend of 6 percent does not seem particularly large over the four years. It amounts to a 1.5 percent annual increase in Medicare outlays for these types of visits, holding price and quantity fixed.

The incidence of upcoding is particularly concentrated in the state of Connecticut, which experiences 17 percent upcoding in office visits and 7 percent upcoding in hospital visits over the study period. This suggests that upcoding, particularly as a response to the freeze, may be more likely to

TABLE 4-6

TRENDS IN PHYSICIAN UPCODING BY STATE BY QUARTER, 1983-1986

Quarter	Alabama	Connecticut	Washington	Wisconsin	Pooled (4-State) Average
OFFICE VISIT INDEX					
1	1.02	0.96	1.03	0.98	1.00
2	1.03	0.97	1.03	0.99	1.02
3	1.03	0.97	1.03	0.99	1.01
4	1.03	0.97	1.02	1.00	1.02
5	1.03	0.97	1.02	0.99	1.02
6	1.04	1.00	1.02	1.00	1.04
7	1.04	1.01	1.03	1.00	1.03
8	1.05	1.05	1.03	1.00	1.04
9	1.05	1.05	1.03	1.00	1.03
10	1.06	1.06	1.04	1.01	1.06
11	1.06	1.07	1.04	1.01	1.05
12	1.06	1.07	1.04	1.01	1.05
13	1.06	1.08	1.04	1.01	1.05
14	1.07	1.10	1.04	1.01	1.06
15	1.07	1.11	1.04	1.01	1.06
16	1.07	1.13	1.04	1.01	1.06
HOSPITAL VISIT INDEX					
1	1.02	0.95	1.02	1.00	1.00
2	1.04	0.96	1.03	1.02	1.00
3	1.04	0.96	1.03	1.01	1.00
4	1.04	0.96	1.03	1.03	1.00
5	1.04	0.97	1.04	1.02	1.00
6	1.06	0.97	1.05	1.05	1.01
7	1.06	0.98	1.05	1.04	1.02
8	1.06	0.98	1.05	1.05	1.03
9	1.05	0.98	1.05	1.04	1.03
10	1.07	1.01	1.06	1.06	1.04
11	1.07	1.01	1.06	1.05	1.04
12	1.07	1.00	1.06	1.06	1.04
13	1.06	1.00	1.06	1.05	1.04
14	1.07	1.02	1.06	1.07	1.05
15	1.07	1.02	1.07	1.06	1.06
16	1.06	1.02	1.06	1.06	1.06

Source: Medicare Part B claims from Alabama, Connecticut, Washington, and Wisconsin, 1983-1986.

occur in urban states with greater concentrations of physicians, such as Connecticut. This is a hypothesis best tested in the multivariate analysis of upcoding given below.

4.8.2 Regression Results for Upcoding

While the descriptive results on upcoding are interesting and provocative, they do not definitely answer the question of whether the freeze per se was responsible for some increase in the rate of upcoding. To get at this question, we regressed our indices of upcoding on the same set of controls used in our earlier regression work.

The results of these regressions, for both office and hospital visits, can be found in Table 4-7. First, note that the pattern of RMAC effects is generally the opposite of what we found in our weighted and raw quantity work. Here, the RMAC takes on a net positive coefficient indicating that, if anything, the freeze led to reductions in upcoding.

Conversely the coefficients on inpatient days also differ from the previous results. While the sum is still a net negative in the hospital visit work, the pattern of coefficients starts negative and ends up positive, the opposite of what we found for expenditures and quantities. Moreover, in the office visits regression, the summed inpatient days effects are net positive, indicating that declines in inpatient days may have reduced office visit upcoding.

An examination of the other coefficients in the regression offers some clue as to what is driving the trends in upcoding. The strong positive coefficient on per capita income suggests that upcoding is more prevalent in areas characterized by a strong and growing economy (such as Connecticut). Likewise, office visit upcoding is most likely to occur where physician competition is more extensive, suggesting one alternative for maintaining physician incomes. It may also reflect increasing specialization and the higher reported complexity of specialist visits. More research is needed before stronger conclusions can be drawn about the determinants of upcoding.

TABLE 4-7

REGRESSION RESULTS: ANALYSIS OF UPCODING

	Hospital Visits	Office Visits
Index: Real Medicare Allowed Charge (RMAC)	0.45***	0.18***
Lag 1 (RMAC)	-0.10**	0.12*
Medicare Hospital Days/Pop (MHDP)	-0.02***	-0.02**
Lag 1 (MHDP)	-0.04*	-0.04
Lag 2 (MHDP)	-0.02	0.04
Lag 3 (MHDP)	-0.07**	-0.09**
Lag 4 (MHDP)	0.11***	0.14***
Per Capita Income (PCI)	3.6E-5***	5.2E-5***
HMO Enrollment/Population (HMOPOP)	-7.4E-4***	-7.3E-4*
Physicians/Population (MDPOP)	-1.56***	-0.42*
Percent Urban	0.70***	0.19***
Quarter 4	-0.004**	-0.002
R^2	.95	.97
F	491.45	747.72
DF	288	288

***Significant at one percent level.
**Significant at five percent level.
*Significant at ten percent level.

Source: Medicare Part B claims from Alabama, Connecticut, Washington, and Wisconsin, 1983-1986.

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APPENDIX A

STATE-SPECIFIC TABLES

TABLE A-1

TOTAL MEDICARE PHYSICIAN EXPENDITURES PER BENEFICIARY FOR ALABAMA, 1983-1986

HALFYEAR	TOTAL	MED CARE	CONSULT	SURGERY	ANESTHESIA	ASST SURG	RADIOLOGY	LAB	SPECIAL TESTS	OTHER
JANUARY-JUNE 1983	$220.40	$79.96	$5.83	$67.93	$8.15	$10.13	$26.87	$8.31	$11.85	$1.37
JULY-DECEMBER 1983	222.69	76.46	5.78	69.59	9.07	10.03	28.14	8.28	11.79	3.56
JANUARY-JUNE 1984	239.10	79.49	6.30	76.25	10.00	12.00	29.98	8.81	12.40	3.87
JULY-DECEMBER 1984	224.42	71.57	5.51	75.41	9.87	11.71	27.17	6.68	12.34	4.17
JANUARY-JUNE 1985	249.68	79.76	6.25	82.40	10.86	13.07	31.07	7.01	14.62	4.62
JULY-DECEMBER 1985	253.90	77.46	6.58	86.21	11.17	13.03	31.94	7.80	15.23	4.49
JANUARY-JUNE 1986	293.41	92.12	7.99	98.33	11.80	13.85	37.23	8.47	18.45	5.17
JULY-DECEMBER 1986	307.18	94.63	7.96	105.97	11.66	14.45	39.03	8.71	19.64	5.13
% CHANGE 1983-1984	4.6%	-3.4%	1.7%	10.3%	15.4%	17.6%	3.9%	-6.6%	4.7%	63.1%
% CHANGE 1984-1985	8.6	4.1	8.6	11.2	10.9	10.1	10.3	-4.4	20.7	13.3
% CHANGE 1985-1986	19.3	18.8	24.3	21.2	6.5	8.4	21.0	16.0	27.6	13.1
% CHANGE 1983-1986	35.5	19.4	37.4	48.6	36.2	40.4	38.6	3.6	61.1	108.9

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE A-2

TOTAL MEDICARE PHYSICIAN EXPENDITURES PER BENEFICIARY FOR CONNECTICUT, 1983-1986

HALFYEAR	TOTAL	MED CARE	CONSULT	SURGERY	ANESTHESIA	ASST SURG	RADIOLOGY	LAB	SPECIAL TESTS	OTHER
JANUARY-JUNE 1983	$229.53	$85.89	$9.83	$80.80	$11.07	$3.73	$24.87	$2.55	$8.77	$2.03
JULY-DECEMBER 1983	249.21	91.07	10.60	89.03	11.91	3.82	27.67	2.77	10.09	2.26
JANUARY-JUNE 1984	262.60	93.17	11.31	94.29	12.61	4.33	30.92	3.12	10.83	2.02
JULY-DECEMBER 1984	259.36	92.28	10.73	92.89	12.21	4.39	30.92	2.92	11.21	1.83
JANUARY-JUNE 1985	283.12	99.47	11.78	101.56	13.16	5.05	33.98	3.16	13.62	1.35
JULY-DECEMBER 1985	289.46	98.16	11.93	106.06	13.61	5.20	35.10	3.52	14.31	1.56
JANUARY-JUNE 1986	296.72	96.79	12.15	107.35	14.14	3.68	37.89	3.91	15.33	5.48
JULY-DECEMBER 1986	319.31	101.50	13.14	116.14	14.51	3.32	42.85	4.41	18.06	5.37
% CHANGE 1983-1984	9.0%	4.8%	7.9%	10.2%	8.0%	15.5%	17.7%	13.5%	16.9%	-10.3%
% CHANGE 1984-1985	9.7	6.6	7.6	10.9	7.9	17.5	11.7	10.6	26.7	-24.4
% CHANGE 1985-1986	7.6	0.3	6.7	7.6	7.0	-31.7	16.9	24.6	19.5	272.9
% CHANGE 1983-1986	28.7	12.1	23.8	31.6	24.7	-7.3	53.7	56.4	77.0	152.9

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE A-3

TOTAL MEDICARE PHYSICIAN EXPENDITURES PER BENEFICIARY FOR WASHINGTON, 1983-1986

HALFYEAR	TOTAL	MED CARE	CONSULT	SURGERY	ANESTHESIA	ASST SURG	RADIOLOGY	LAB	SPECIAL TESTS	OTHER
JANUARY-JUNE 1983	$205.65	$61.86	$5.66	$72.85	$10.89	$5.37	$29.97	$8.53	$10.01	$0.51
JULY-DECEMBER 1983	209.86	62.74	5.80	75.56	11.37	5.40	29.86	8.13	10.51	0.50
JANUARY-JUNE 1984	244.51	73.88	6.63	87.96	13.05	6.32	34.24	8.82	13.17	0.45
JULY-DECEMBER 1984	223.69	67.33	6.05	82.34	12.26	5.85	31.06	5.58	12.87	0.35
JANUARY-JUNE 1985	278.43	82.78	7.39	99.59	14.41	7.15	39.37	6.71	16.57	4.47
JULY-DECEMBER 1985	283.62	80.08	7.51	105.30	14.94	7.00	39.86	7.08	17.13	4.73
JANUARY-JUNE 1986	304.06	86.75	8.12	112.27	15.49	6.24	42.84	7.53	19.36	5.46
JULY-DECEMBER 1986	304.40	84.99	8.24	112.45	16.25	6.04	43.96	7.51	19.81	5.15
% CHANGE 1983-1984	12.7%	13.3%	10.6%	14.7%	13.7%	13.0%	9.1%	-13.6%	26.9%	-20.8%
% CHANGE 1984-1985	20.0	15.3	17.5	20.3	16.0	16.3	21.3	-4.2	29.4	1050.0
% CHANGE 1985-1986	8.3	5.5	9.8	9.7	8.1	-13.2	9.6	9.1	16.2	15.3
% CHANGE 1983-1986	46.4	37.8	42.8	51.4	42.6	14.0	45.1	-9.7	90.9	950.5

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE A-4

TOTAL MEDICARE PHYSICIAN EXPENDITURES PER BENEFICIARY FOR WISCONSIN, 1983-1986

HALFYEAR	TOTAL	MED CARE	CONSULT	SURGERY	ANESTHESIA	ASST SURG	RADIOLOGY	LAB	SPECIAL TESTS	OTHER
JANUARY-JUNE 1983	$227.61	$75.18	$6.56	$80.74	$10.00	$3.84	$27.78	$11.02	$10.26	$2.22
JULY-DECEMBER 1983	234.60	75.08	6.90	84.69	10.75	4.02	27.32	11.99	10.62	3.22
JANUARY-JUNE 1984	244.95	77.24	7.32	89.64	11.58	4.25	28.18	11.67	11.70	3.37
JULY-DECEMBER 1984	241.27	74.55	7.08	92.20	11.08	4.12	28.02	9.46	11.88	2.89
JANUARY-JUNE 1985	247.93	76.43	7.39	95.22	11.15	4.09	29.33	9.56	12.74	2.03
JULY-DECEMBER 1985	255.74	75.47	7.71	101.42	11.22	4.00	30.36	10.55	13.25	1.75
JANUARY-JUNE 1986	260.95	76.33	8.06	96.48	11.86	3.57	32.24	10.86	14.87	6.70
JULY-DECEMBER 1986	263.93	75.82	8.08	98.30	12.48	3.42	31.62	10.41	15.76	8.03
% CHANGE 1983-1984	5.2%	1.0%	7.0%	9.9%	9.2%	6.5%	2.0%	-8.2%	12.9%	15.1%
% CHANGE 1984-1985	3.6	0.1	4.9	8.1	-1.3	-3.3	6.2	-4.8	10.2	-39.6
% CHANGE 1985-1986	4.2	0.2	6.9	-0.9	8.8	-13.6	7.0	5.8	17.9	289.7
% CHANGE 1983-1986	13.6	1.3	19.9	17.7	17.3	-11.1	15.9	-7.6	46.7	170.8

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE A-5

TOTAL NUMBER OF OFFICE AND HOSPITAL VISITS PER BENEFICIARY, 1983-1986

HALFYEAR	ALABAMA		CONNECTICUT		WASHINGTON		WISCONSIN		ALL STATES	
	OFFICE	HOSPITAL	OFFICE	HOSPITAL	OFFICE	HOSPITAL	OFFICE	HOSPITAL	OFFICE	HOSPITAL
JANUARY-JUNE 1983	1.56	2.11	1.47	1.42	1.46	0.93	1.42	1.61	1.48	1.53
JULY-DECEMBER 1983	1.47	1.88	1.55	1.33	1.41	0.85	1.40	1.43	1.45	1.38
JANUARY-JUNE 1984	1.55	1.96	1.56	1.35	1.65	0.92	1.45	1.40	1.54	1.41
JULY-DECEMBER 1984	1.57	1.53	1.56	1.26	1.50	0.74	1.49	1.19	1.52	1.18
JANUARY-JUNE 1985	1.70	1.74	1.64	1.23	1.82	0.89	1.52	1.14	1.66	1.24
JULY-DECEMBER 1985	1.73	1.57	1.67	1.11	1.77	0.81	1.56	1.05	1.68	1.13
JANUARY-JUNE 1986	1.91	1.76	1.68	1.09	1.88	0.87	1.60	1.03	1.76	1.18
JULY-DECEMBER 1986	1.95	1.53	1.69	1.05	1.85	0.81	1.62	0.95	1.77	1.08
% CHANGE 1983-1984	3.0%	-12.5%	3.3%	-5.1%	9.8%	-6.7%	4.3%	-14.8%	4.4%	-11.0%
% CHANGE 1984-1985	9.9	-5.2	6.1	-10.3	14.0	2.4	4.8	-15.4	9.2	-8.5
% CHANGE 1985-1986	12.5	-0.6	1.8	-8.5	3.9	-1.2	4.5	-9.6	5.7	-4.6
% CHANGE 1983-1986	27.4	-17.5	11.6	-22.2	30.0	-5.6	14.2	-34.9	20.5	-22.3

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

TABLE A-6

MEDICARE PART B EXPENDITURES PER BENEFICIARY FOR OFFICE AND HOSPITAL VISITS, 1983-1986

	ALABAMA		CONNECTICUT		WASHINGTON		WISCONSIN		ALL STATES	
HALFYEAR	OFFICE	HOSPITAL	OFFICE	HOSPITAL	OFFICE	HOSPITAL	OFFICE	HOSPITAL	OFFICE	HOSPIT
JANUARY-JUNE 1983	$25.81	$41.85	$32.33	$33.99	$29.38	$24.07	$23.78	$34.92	$27.35	$33.83
JULY-DECEMBER 1983	25.78	40.26	36.39	34.08	30.01	23.97	24.92	35.17	28.68	33.50
JANUARY-JUNE 1984	27.36	42.21	36.63	34.93	35.20	26.28	25.94	35.27	30.69	34.72
JULY-DECEMBER 1984	28.35	33.57	38.14	33.89	32.46	21.70	27.01	30.98	30.91	29.94
JANUARY-JUNE 1985	30.87	38.10	41.89	34.28	39.61	25.71	27.77	30.11	34.27	31.83
JULY-DECEMBER 1985	31.70	34.95	44.18	31.94	39.10	23.84	28.77	27.76	35.12	29.40
JANUARY-JUNE 1986	36.03	42.93	45.88	32.06	41.62	26.02	29.63	27.72	37.42	31.90
JULY-DECEMBER 1986	38.53	41.59	47.72	32.04	41.73	24.58	30.67	26.14	38.75	30.72
% CHANGE 1983-1984	8.0%	-7.7%	8.8%	1.1%	13.9%	-0.1%	8.7%	-5.5%	9.9%	-4.0%
% CHANGE 1984-1985	12.3	-3.6	15.1	-3.8	16.3	3.3	6.8	-12.6	12.6	-5.3
% CHANGE 1985-1986	19.2	15.7	8.7	-3.2	5.9	2.1	6.7	-6.9	9.8	2.3
% CHANGE 1983-1986	44.5	2.9	36.2	-5.8	40.3	5.3	23.8	-23.2	35.9	-7.0

SOURCE: MEDICARE PART B CLAIMS FOR ALABAMA, CONNECTICUT, WASHINGTON, AND WISCONSIN.

APPENDIX B

TABLE OF TOTAL CHARGES

TABLE B-1

SAS 12:39 FRIDAY, NOVEMBER 18, 1988

STATE	YEAR	MENR	TOTALL	TOSCHG1	TOSCHG2	TOSCHG3	TOSCHG4	TOSCHG5	TOSCHG6	TOSCHG7	TOSCHG8
	.	8390263	4293818152	1354994733	1536566509	132199443	542595731	129948708	200184105	110164779	230203213
	83	2043426	917053515	307941781	316926494	28425896	113595055	33323306	42212918	23478607	42955754
	84	2076106	1001897146	322915950	357944474	30849499	123857045	31204546	47772811	27177254	50053141
	85	2115263	1122411244	348402147	409469445	34251929	141783209	30729668	52519061	30432494	61656364
	86	2155468	1252456247	375734855	452226096	38672119	163355422	34691188	57679295	29076424	75537954
AL	.	2055388	1033500327	334498461	340545397	26833739	129249748	32857930	42441487	30516132	39870368
AL	83	500756	221483078	78178828	68742868	5805395	27498637	8293516	8604938	10078481	11812554
AL	84	508085	235141388	76626778	76944910	5988914	28985489	7854160	10079169	12029776	12554320
AL	85	518556	260445010	81306506	87211352	6634851	32588396	7657414	11395427	13497994	15438213
AL	86	527991	316430851	98386349	107646267	8404579	40177226	9052840	12361953	14909881	20065281
CT	.	1689732	924621285	319981697	332904071	38615379	111696829	11146129	43582483	14130238	43271150
CT	83	412718	197236599	72901087	69967222	8418090	21646274	2190348	9464764	3111997	7771382
CT	84	419201	218385485	77591193	78314899	9217968	25973545	2523650	10363783	3646479	9223079
CT	85	425933	243374466	83995178	88254161	10075066	29361896	2841564	11379873	4354900	11875740
CT	86	431880	265624735	85494239	96367789	10904235	34815114	3590567	12354063	3016862	14400949
WA	.	2049059	1053520161	307661765	383927048	28406512	149318396	30534674	55704604	25243509	61421436
WA	83	491859	203747703	61096235	72774914	5623107	29337290	8167369	10912742	5279078	10062050
WA	84	504449	235412928	71004571	85631652	6373255	32828554	7232390	12726167	6115537	13096601
WA	85	518609	290542000	84168313	105924723	7702331	40955349	7128231	15173964	7313738	17419059
WA	86	534142	323817530	91392646	119595759	8707819	46197203	8006684	16891731	6535156	20843726
WI	.	2596084	1282176379	392852810	479189993	38343813	152325758	55409975	58455531	20274900	65640259
WI	83	638093	294586135	95765631	105441490	8579304	35112854	14672073	13230474	5009051	13309768
WI	84	644371	312957345	97693408	117053013	9269342	36169457	13594346	14583692	5385462	15179141
WI	85	652165	328049768	98932150	128079209	9839681	38877568	13102459	14569817	5265862	16923352
WI	86	661455	346583131	100461621	128616281	10655486	42165879	14041097	16071548	4614525	20227998

Source: Medicare Part B Claims for Alabama, Connecticut, Washington, and Wisconsin.

Key: MENR = Medicare Part B Beneficiaries
TOTALL = Total Allowed Charges
TOSCHG1 = Total Allowed Charges for Medical Care
TOSCHG2 = Total Allowed Charges for Surgery
TOSCHG3 = Total Allowed Charges for Consultations
TOSCHG4 = Total Allowed Charges for Radiology
TOSCHG5 = Total Allowed Charges for Laboratory
TOSCHG6 = Total Allowed Charges for Anesthesia
TOSCHG7 = Total Allowed Charges for Assistant Surgery
TOSCHG8 = Total Allowed Charges for Special Tests

Note: "Other" physician services constitute a residual category, i.e., (TOTALL - TOSCHG1-8).